Detroit Water and Sewerage Department

Wastewater Master Plan
Volume 7

Implementation

CDM Camp Dresser & McKee

Draft – June 25 . 2003

Detroit Water and Sewerage Department

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Executive Summary

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 from 500 square miles to 904 square miles today. 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. 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 falls within three major watersheds – the Rouge, the Clinton, and the Lake St. Clair / Detroit River. The regional wastewater system currently serves 80 per-

cent of the population in those planning area. The other 20 percent of 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 watersheds, 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 late in 2003.

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 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 wet weather flows up to the 10-year 1-hour design storm (about 1.9 inches per hour of rainfall.

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 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 pipeline connected to the wastewater treatment plant is 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 10 200 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 SSO to the regional system for treatment. A regional approach with customer community costs totaling $124 million has been identified which, if implemented, would slightly increase the annual volume of CSO discharged. A solution with no new CSO displacement would cost communities $40 million more.

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 provided by a regional approach. Truly, the word "we" applies for seeking wastewater solutions over the next 50 years.

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 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:

- Managing Capacity and Flows
- Expanded Rehabilitation Efforts
- 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 proposed 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 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 an- 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, 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 draft Master Plan report is presented in 7 volumes, plus a CD with over 60 detailed technical memoranda.

Executive Summary

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

DWSD seeks comments and updates or corrections to the information presented herein. Written comments should be sent by August 7, 2003 to:

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Comment at the web site as follows:

www.dwsd-wwmp.com

Username: dwsdwwmp

Password: cs1314

1. Introduction

Objectives of the Master Plan

The Detroit Water and Sewerage Department (DWSD) has prepared this Master Plan to guide the expansion, rehabilitation, and operational efficiency of its regional wastewater system to the year 2050.

This plan has been developed with review and advice from Detroit's customers – retail and wholesale – through the First Tier Customer Partnership Program, special technical work group meetings, and neighborhood police precinct meetings.

The plan has also been tied to other regional planning efforts, including the most recent Areawide Water Quality Management Plan (208 Plan) prepared by SEMCOG in October 2000, current policy of the Michigan Department of Environmental Quality, and the goals of the Water Quality Consortium headed by the U.S. District Court of Southern Michigan, Eastern Division.

It is recommended that this plan be updated every 10 years by the DWSD.

Organization of the Plan

This plan is organized in 8 volumes:

Volume 1: Planning Criteria

Volume 2: Critical Facilities and Flow Management

Volume 3: Wastewater Service Alternatives

Volume 4: Capital Improvement Program

Volume 5: Customer Service and Technical Support Program

Volume 6: Evaluation of Regional SSO Controls

Volume 7: Implementation

Volume 8: Technical Memoranda

Volume 8 is presented as a compact disk with 65 technical memoranda on detailed evaluations or documentation in support of particular aspects of the Master Plan. The table of contents of each volume references the technical memoranda applicable to that volume.

Response to Comments

This is version of the Master Plan is a draft for review by the public, including DWSD's customers. This Master Plan is being released for comment in June 2003 and comments will be accepted in writing through August 21, 2003. The different volumes of the Master Plan have been distributed as interim reports for comment as they were developed starting in October 2001. Comments received in earlier reviews have been incorporated in this current version. Comments should be directed to:

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The final Master Plan will make revisions where appropriate based on comments. Also, comments will be reproduced and addressed in a new technical memorandum to the plan.

2. System Overview

2.1 Existing Wastewater Facilities

The DWSD has one wastewater treatment plant located at 9300 West Jefferson in Detroit. Construction is underway at the plant to provide 1,700 million gallons per day of primary treatment capacity and 930 million gallons per day of secondary treatment capacity. When this construction is completed in 2006, Detroit's wastewater treatment plant will be the largest in the world as measured by primary treatment capacity.

The wastewater plant has been upgraded and expanded several times since the original construction was completed in 1939. The plant became operational in February 1940. There are four principle regional interceptors: Detroit River Interceptor, Oakwood Interceptor, Northwest Interceptor and North Interceptor-East Arm. These interceptors were built in the 1930s, except for the North Interceptor-East Arm, which was built in the 1970s. There are 14 DWSD-owned pumping stations, 46 customer meters and 10 internal system meters. There are approximately 3,383 miles of sewer in the City of Detroit and an estimated 8,770 miles in the suburban communities served by Detroit. There are an estimated 1.5 million service connection points to homes and businesses. There are 23 CSO control facilities and wet weather flow equalization tanks. Over 96 percent of the sewers in Detroit (by length) were constructed prior to 1960, and over 88 percent were constructed prior to 1940 according to DWSD maps and engineering records.

Most of the City of Detroit has a combined sewer system. However, there is one area on the far east side that was built with 49 miles of separate sewers. Also, reconstruction of the system in the last 50 years has resulted in the construction of a number of sanitary sewers and separate storm drains that are recombined downstream of the redevelopment projects.

The collection system was constructed over a period of 140 years as Detroit grew from a settlement to a metropolitan area. The principal materials of construction were crock (a type of vitrified clay pipe), polyvinyl chloride pipe (PVC), clay, reinforced concrete pipe (RCP), concrete cylinder pipe (CCP), and brick. Wood boxes formerly used for transport have all been replaced. Figure 2.1 shows current sewer type and length in DWSD system. Figure 2.2 breaks this down by construction material.

The construction standard for public sewers installed from 1836 to 1910 was brick. Until 1892, laterals were also constructed of brick. The first public sewer was constructed in 1836, when Savoyard Creek, which flowed from Cadillac Square to the foot of First Street, was enclosed.

Many sewers were constructed before streets were in place so the sewers were built in long reaches

Figure 2.1: Estimated Sewer Type and Length in DWSD System

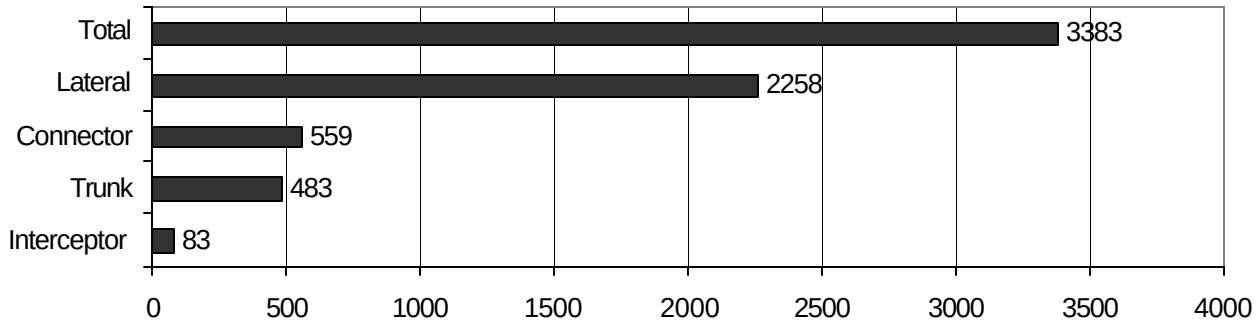
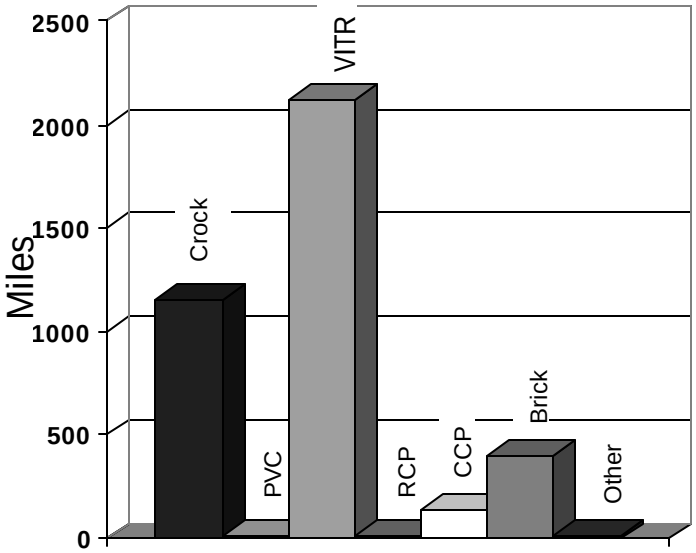


Figure 2.2: Detroit Sewer Materials and Length in Miles



Material	Length (miles)
Glazed VCP	941
PVC	12
VCP	1887
RCP	12
CCP	138
Brick	393

with few manholes. In 1892 a change of materials for small lateral sewers was made. "Crock" (the term used to indicate a type of vitrified clay) pipe was introduced and manholes and lampholes were provided for lateral sewers. In the following 20 years, the wastewater collection and transportation system expanded rapidly as extensive areas were annexed into Detroit. Through 1920, most of the public sewers were constructed of brick and were less than seven feet in diameter. In 1926, when the interceptor concept was implemented, monolithic concrete construction was introduced and quickly became the standard for large sewers. Concrete pipe gradually superseded crock pipe. By 1930 it represented half of new lateral construction.

The Detroit collection system was expanded to the present city limits by 1951. Construction continued under the combined sewer relief program during this period. By 1975, lateral sewer construction had been completed in the last undeveloped areas and in the inner-city urban renewal and rehabilitation areas. Short lateral sections and replacement sewers were constructed as needed. Table 2.1 shows lateral sewer conditions.

The regional system drains to four interceptors: the Detroit River Interceptor , the North Interceptor - East Arm, the Oakwood Interceptor , and the North West Interceptor .

The Detroit River Interceptor was constructed in three major stages from 1927 to 1936. The materials of construction were concrete and brick.

The North Interceptor - East Arm was constructed from 1969 to 1976. The material of construction was reinforced concrete.

The Oakwood Interceptor was constructed in the early 1930s. The Federal Emergency Administration of Public Works (FEAPW) administered a program of public sewer cleaning and repair of older sewers. Interceptor and wastewater treatment plant con-

Table 2.1: Lateral Sewer Segment Conditions

	North		West		East		Central		Total	Percent of Total
Segments inspected	166		178		165		128		637	100%
Excellent	9	5.40%	7	3.90%	16	9.70%	6	4.70%	38	6.00%
Good	74	44.60%	95	53.40%	105	63.60%	67	52.30%	342	53.80%
Fair	63	38.00%	48	27.00%	30	18.20%	32	25.00%	174	27.30%
Needs Investigation	20	12.00%	28	15.70%	19	11.50%	20	15.60%	87	13.70%

struction was underway in the years 1935 through 1940. In 1940 the Detroit River Interceptor, the Oakwood-Northwest Interceptor, and the original Detroit primary Wastewater Treatment Plant were completed.

The North West Interceptor was constructed from 1928 to 1950. The material of construction was reinforced concrete. A number of different construction materials have been used for the interceptors. The majority of Detroit's large sewers are constructed of concrete. A few older sections of the DRI are multi-ring brick sewers. Deeper sewers were most often installed using pre-cast concrete liners in tunnels. Further, cast-in-place reinforced concrete was employed during the construction of some box sections and structures, such as outfalls and dams.

The Lakeshore Interceptor was constructed in 1972 from reinforced concrete. The 11-foot diameter sewer provides transport of wastewater for the eastern portion of Macomb County. It extends from 21-Mile Road southward for approximately 36,000 feet where it empties into the 15-Mile Interceptor. The Clintondale Pump Station discharges into the south end of this interceptor and the Chesterfield Interceptor feeds into the north end.

The Oakland Arm was constructed in two major construction contracts from 1970 to 1972. This nine-foot diameter, approximately 57,500-foot long sewer provides transport of wastewater for portions of Macomb and Oakland County. It ultimately discharges into the Northeast Sewage Pumping Station in Detroit.

The Edison Corridor was constructed in 1969 from concrete. This 12-foot 9-inch diameter sewer provides transport of wastewater for a portion of Macomb County. The capacity of this 41,300-foot long sewer is 823 cfs.

The Garfield/Romeo Interceptor was constructed in three major construction contracts from 1973 to 1999. The material of construction was concrete. The 7- to 11-foot diameter sewer provides transport of wastewater for a portion of Macomb County. The Romeo Arm extends from 15 Mile Road north along Hayes to 18 Mile Road. This sewer crosses the Price Brook, Eaton, Healy Brook and Nims Drains. The force-main portion of this sewer, which extends north from 18 Mile Road, and the Garfield Pump Station are being replaced by the construction of a large gravity sewer. Construction on this new Garfield Interceptor is expected to be completed in August 2003. It will have a capacity of 161 cfs.

The 15-Mile Road Interceptor was constructed in four major construction contracts from 1973 to 1984. The material of construction was reinforced concrete. This 5- to 11-foot diameter sewer provides transport of wastewater for a portion of Macomb County. This sewer is approximately 36,500 feet long.

The Avon Arm was constructed in 1974 from concrete. The 3- to 4-foot diameter concrete sewer providing wastewater transport for portions of Macomb and Oakland counties is approximately 14,000 feet long.

DWSD maintains 63 major meters throughout its service area. Of these, 56 are important billing or flow-monitoring meters, and seven are meters at the Wastewater Treatment Plant measuring incoming flow.

3. Major Findings and Conclusions

Major findings and conclusions of the wastewater Master Plan are presented below. Additional detail in support of these findings and conclusions is presented in Volumes 1 to 6, along with the associated technical memoranda for each volume.

Findings and conclusions are presented in 13 major areas:

1. Planning Area and Regional Wastewater Service Area

2. Population Projections

3. Dry Weather Flows

4. Sanitary Sewer Overflows and Wet Weather Flows

5. Wastewater System Infrastructure

6. Policy, Practice and Regulations

7. Facilities on Private Property

8. Wastewater Service Alternatives

9. Long Term CSO Control Plan

10. Wastewater Treatment Plant

11. Capital Improvement Program and Financial Planning

12. Flow Management

13. Human Resources

14. Information Technology

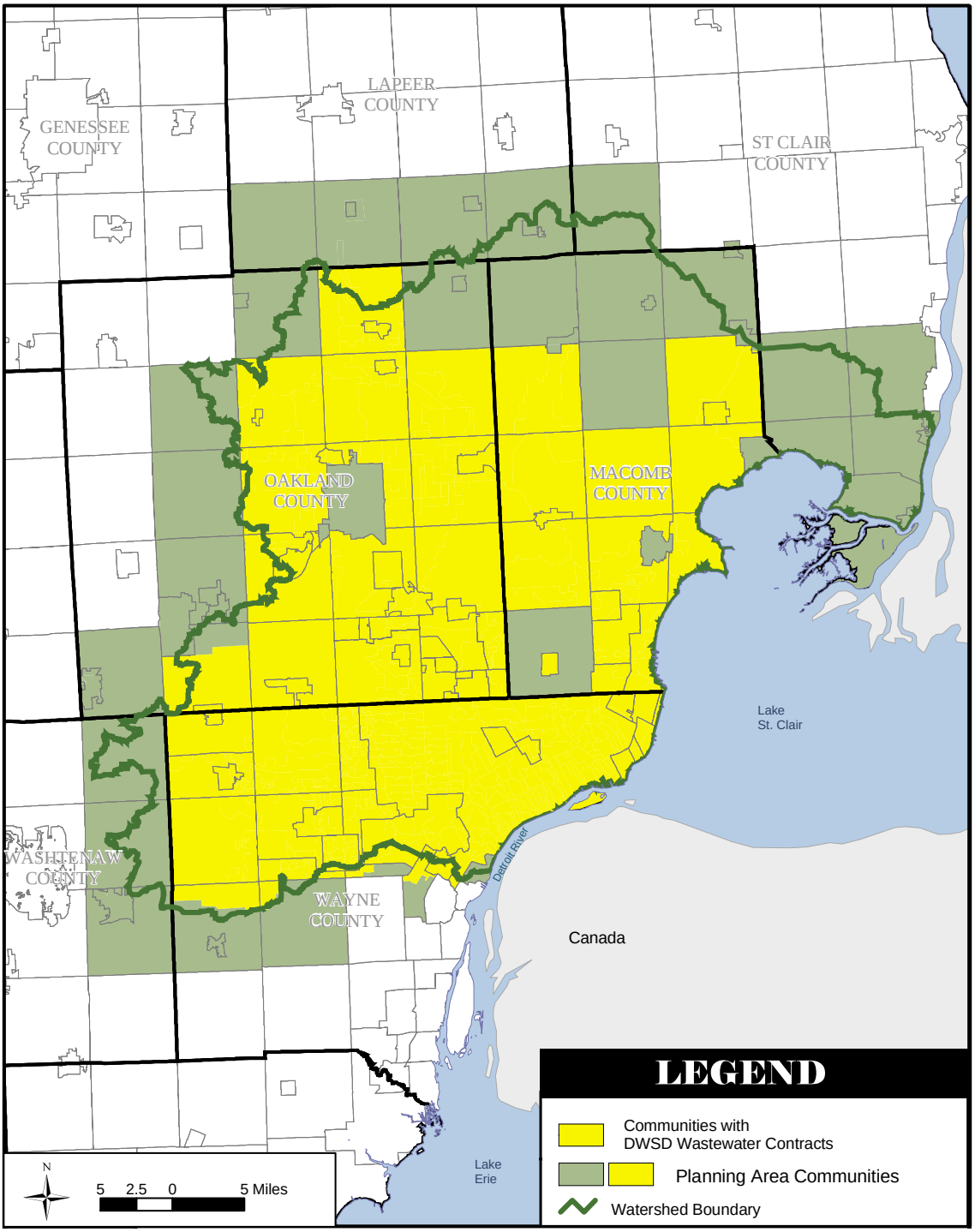
3.1 Planning Area and Regional Wastewater Service Area

The Wastewater Master Plan has been prepared within the broader context of the water resource environment of Southeast Michigan. The 208 Water Quality Management Plan (SEMCOG, October 1999) establishes goals for management of Southeast Michigan's water resources, and provides guiding principles for wastewater planning. These principles include:

- Encourage the full use of existing infrastructure before building new facilities.
- Be guided by local governments in determining the wastewater infrastructure needs of individual communities.
- Consider local and regional sustainable development goals.
- Promote collaboration among local governments and the state.
- Use only water quality management strategies that are technically, environmentally, economically, politically and socially feasible.
- Integrate area-wide water quality planning with other planning efforts, including emerging local, regional, state and federal policies and programs geared toward sustainable development.
- Encourage public participation in the planning process.
- Provide sufficient sanitary sewage treatment facilities to ensure protection of public health and the environment and support achievement of designated uses and the sustainability of our environmental resources.

The planning area for the 50-year study has been based on a watershed management approach. The current customer base is located in a 904 square-mile area within three watersheds – Rouge River, Clinton River, and the adjoining parts of the Lake

Figure 3.1: Master Plan Planning Area



St. Clair and Detroit River watersheds. See Figure 3.1. The planning area for the Master Plan considers the entire area of these three watersheds, plus the total area of any township or municipality that falls within these watersheds. As a result, there are 124 communities in the planning area.

There are 36 wastewater treatment providers (22 major providers) in or near the planning area, in addition to the DWSD. The total wastewater treatment capacity of the DWSD and the 22 major providers (after completion of ongoing expansion projects by the DWSD, Wayne County and YCUA) is 2150 mgd on a peak flow rate and secondary or teritiary capacity of 1320 mgd.

The DWSD regional wastewater system serves approximately 80 percent of the population in the planning area in 2003. In the future, it is expected that the area served by DWSD will grow at a slower rate, but it will continue to serve about 75 percent of the population in the planning area into the future.

Analyses performed for this Master Plan show that it is not cost-effective at this time for the DWSD regional system to serve St. Clair County communities. It may be cost-effective to serve a small part of Lapeer County. However this would require further discussions and planning among DWSD, the Oakland County Drain Commissioner, and Lapeer County.

The sewered area within the planning area is expected go grow from 904 square miles in 2000 to about 950 square miles in 2010 to about 980 square miles in 2030 to approximately 1,000 square miles in 2050.

There are numerous projects underway by DWSD and its wholesale customers, transportation agencies, and private developers that will add new flows to the system; rehabilitate, upgrade and extend pipelines and pumping and treatment facilities; and alter the alignment of sewers over the next 50 years. The region can benefit from coordinated scheduling of capital improvement projects. For road, water and sewer infrastructure, coordinated scheduling will reduce construction costs.

DWSD has an established "Sewer Expansion Policy" that broadly defines the requirements any customer would need to comply with in order to receive water or sewer service from DWSD. According to this policy, capital costs will be charged to customers who wish to extend or expand sewer service within their community. This policy is in accordance with DWSD's "Growth Policy" that requires that all system infrastructure growth to be self-supporting.

Customer requests, either for new or expanded service, are sent to the DWSD Director, Deputy Director or one of the Assistant Directors. The requests are then evaluated through an internal process. The Engineering Services Division conducts a technical feasibility study and the Financial Services Division conducts a rate evaluation. This process is illustrated in Figure 3.2.

Once approval has been granted by DWSD to allow a modification to the current conveyance system, permits must be obtained from the proper permitting authorities. In order to perform any modification of a sewer conveyance system, a "Permit Application for Wastewater Systems" must be submitted to the MDEQ per Part 41 of Act 451.

A flowchart showing the permit process is shown on Figure 3.3.

Figure 3.2: Flowchart of the DWSD Process of Approving Service Requests

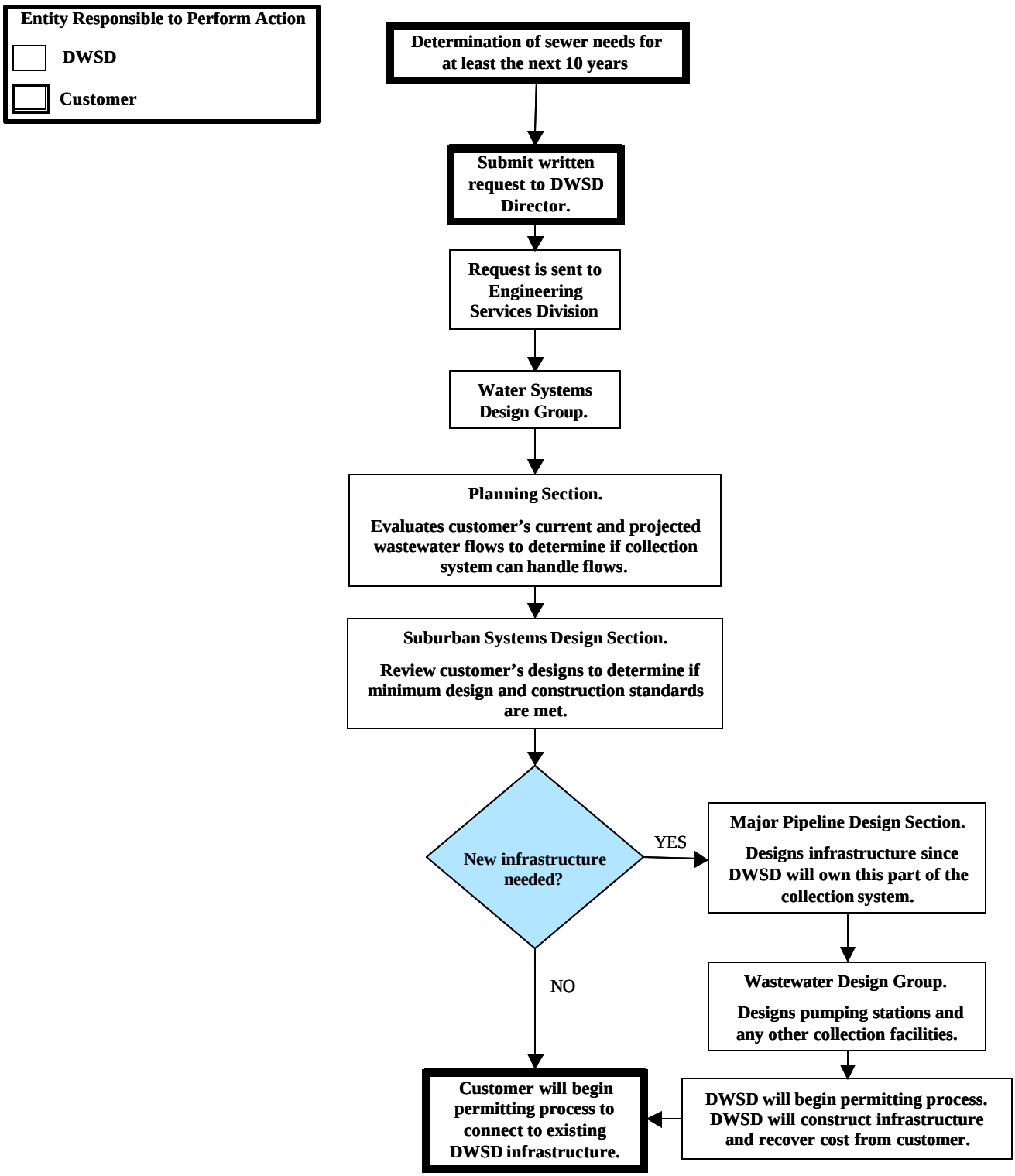
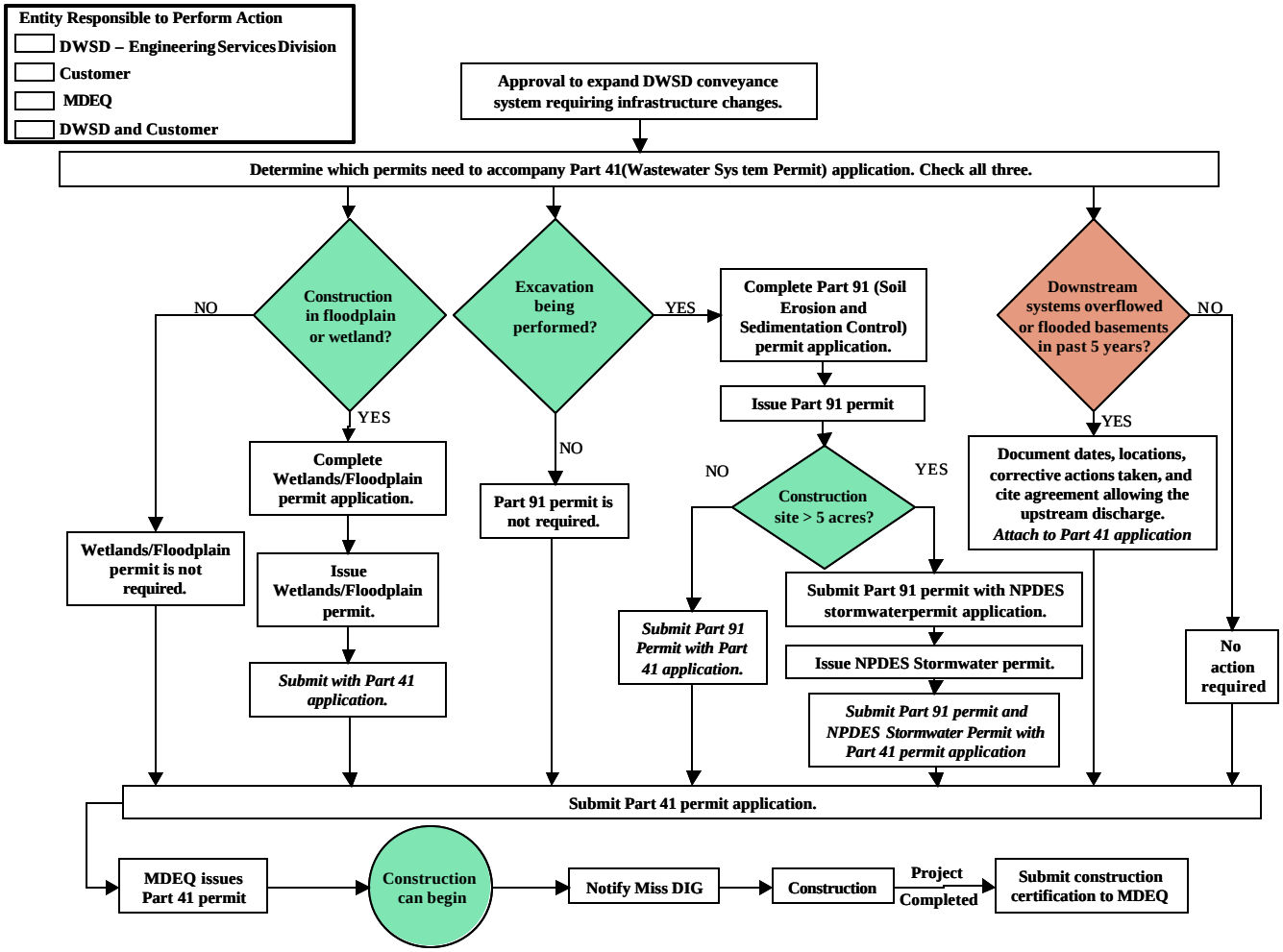


Figure 3.3: Flowchart of Part 41-Wastewater Systems Permit Process



3.2 Population Projections

The 2000 population of the existing DWSD contract area, which includes Detroit and the portions of the 76 existing contract customer communities was 3.2 million. Some homes and businesses within the DWSD contract area are not currently connected to sewers. Thus the 2000 population of the current DWSD sewered area was 3.0 million. By 2050, the population of the current contract area is expected to grow to about 3.4 million while the sewered area is expected to grow to about 3.2 million.

The 2000 population of the entire planning area was 3.8 million. It is expected to grow to 4.3 million by 2050.

Figure 3.4 represents historic and projected populations in Wayne, Oakland and Macomb counties.

Employment is expected to grow from 1.8 million to about 2.0 million in the existing service area, and from 2.1 million to about 2.4 million in the planning area. These are projections by SEMCOG using the official Census Bureau figures for 2000.

3.3 Dry Weather Flows

Dry weather flows include the following components:

- Residential flows
- Commercial, institutional, light industrial
- Major industrial flows (called Significant Industrial Users, or SIUs)
- Water treatment plant discharges
- Hauled wastes (including septage, recreational vehicles, leachate)
- Dry weather infiltration and inflow

Table 3.1 presents an estimated breakdown of these sources for 2001.

Residential wastewater flows in the existing service area average about 77 gallons per person per day, or 210 gallons per household per day. These figures were derived from a survey of 67 communities during which three years of wintertime water usage data was collected. In the future, residential per capita flows are expected to remain constant or decrease to about 70 gpcd as water-

Figure 3.4: Total County Populations and Projections, 1900-2050 in Millions of People

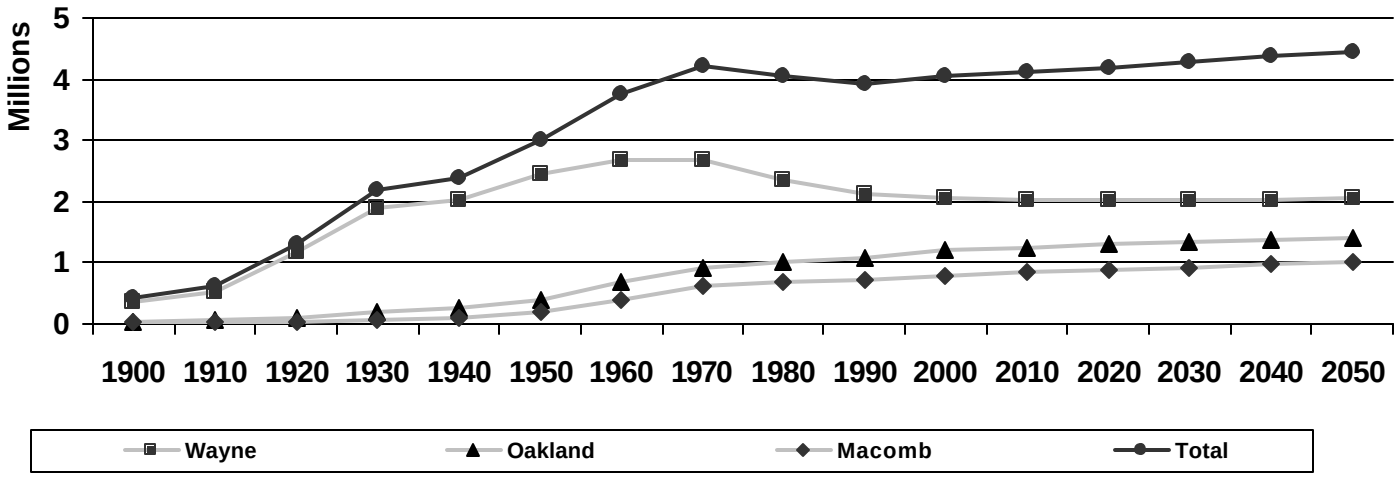


Table 3.1 Dry Weather Flow Components in 2001

Component	Flow (MGD)
Sanitary	
• Residential	255
• Commercial/Institutional/light industrial	84
• Significant Industrial Users	45
• Water Treatment Plants	9
• Hauled Wastes	0.04
Dry Weather Inflow/Infiltration	203
Total	**596**

conserving plumbing fixtures become more widespread.

Commercial, institutional and light industrial flows were analyzed for a variety of businesses, including shopping centers, office buildings, hospitals, schools and colleges. While each business is unique, flows can be estimated with an average of around 50 gallons per employee per day (gped).

Major industrial flows are expected to decline from the current 45 million gallons per day to about 35 million gallons per day by 2050 as industries minimize waste generation and as service industries continue to supplant manufacturing in employment.

The amount of dry weather flow which is received in any year varies in response to annual rainfall. Four years of dry weather flows, from 1998 to 2001, are shown in Table 3.2. Pumped flow is the annual average flow in dry and wet weather expressed in mgd. Influent flow includes plant recycle, which varies from about 50 mgd to 70 mgd. The 2001 dry weather flow was used as the base year for future projections because it had the most complete flow-metering history.

Under the terms of its NPDES permit, the treatment plant must be able to provide full secondary treatment for up to 930 mgd. This flow rate needs to address flows experienced during the peak hour of operation on a dry day, inclusive of recycle flows. Diurnal flows at the wastewater treatment plant are shown in Figure 3.5.

Table 3.2: Dry weather flows 1998-2001

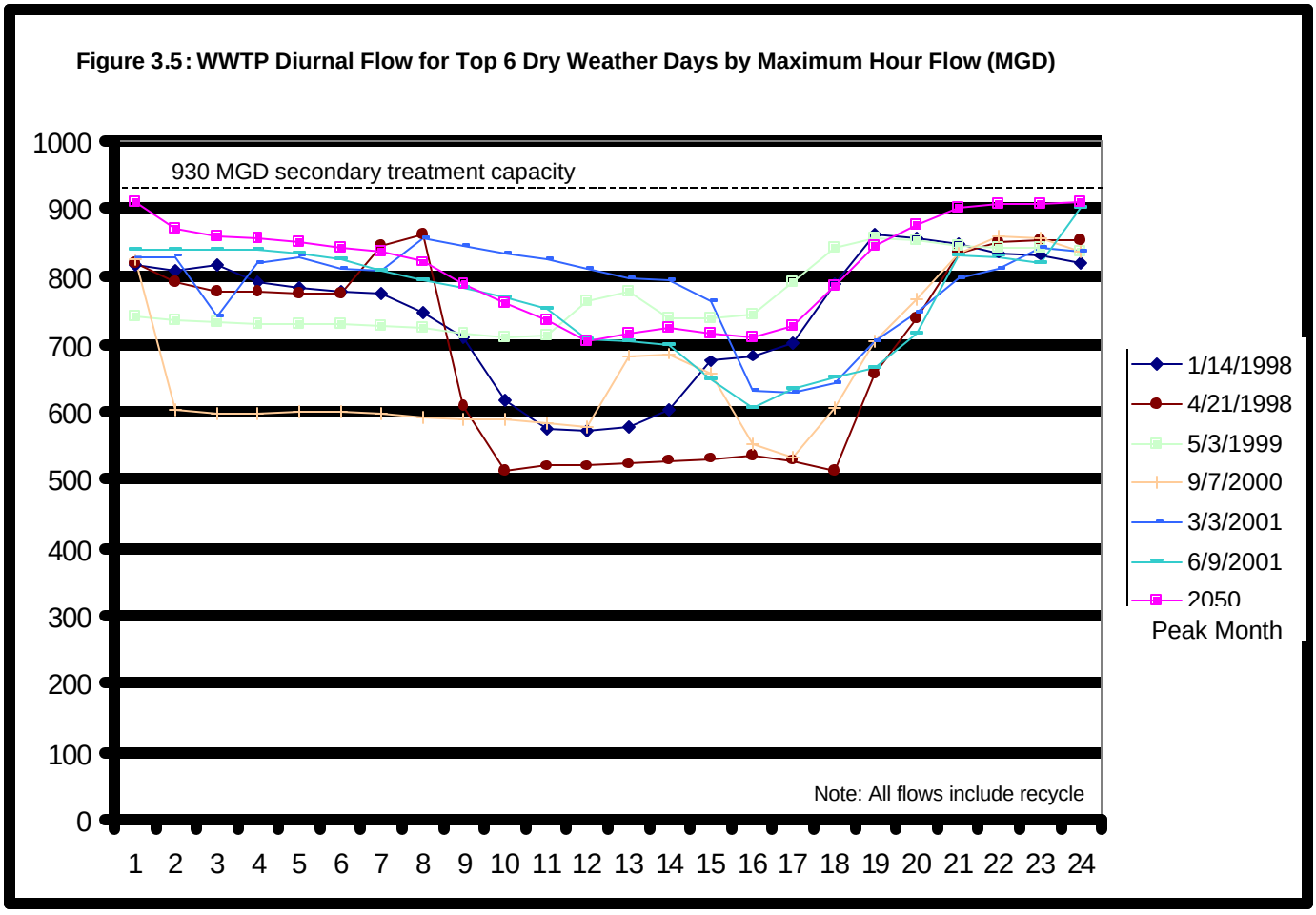
Year	Pumped (MGD)	Influent (MGD)	DWF (MGD)	DWI/I (MGD)	Precipitation (Inches)
1998	728	647	541	158	32.14
1999	726	651	559	176	32.01
2000	735	653	554	171	36.23
2001	797	724	596	212	35.43
2002	700	656	580	225	28.80

Based on the 50-year flow projections, the dry weather peak hour flow is not expected to exceed 808 mgd by 2050, which means that the existing 930 mgd secondary capacity is adequate. The duration of the peak hour flow is approximately 2 hours based on four years of hourly data. There is the ability to store flow in the interceptor system to manage this peak hour limit.

Dry weather infiltration/inflow has ranged from 158 mgd to 212 mgd in the years 1998 to 2001. There are cost-effective opportunities for DWSD and its suburban communities to remove up to approximately 50 mgd of dry weather infiltration inflow over the planning period. (See findings on Flow Management.)

The regional system has capacity for anticipated growth from customer communities in the next 50 years if recommended steps for removing excessive infiltration and inflow are taken.

Figure 3.5: WWTP Diurnal Flow for Top 6 Dry Weather Days by Maximum Hour Flow (MGD)



3.4 Sanitary Sewer Overflows and Wet Weather Flows

Wet weather flows include the following components:

- CSO storage dewatering
- Potential agreements with other providers to accept emergency flows
- Storm water flows from combined sewers
- Rainfall derived I/I from sanitary sewers

Current and projected peak wet weather flows from DWSD's first-tier customers are shown in Table 3.3.

SSOs are releases of untreated sewage into the environment. Such discharges are illegal in Michigan. The Michigan Department of Environmental Quality (MDEQ) policy is to identify separate sanitary sewer overflows and take appropriate regulatory action to eliminate them.

The six local municipalities that served as case studies in the regional analysis are Center Line, Clinton Township, Fraser, Melvindale, Allen Park and Garden City.

Overall, 17 DWSD customers have reported 41 million gallons of SSOs to MDEQ in the two years encompassing July 2000 to July 2002. In the first year, 26 MG was reported; in the second year, 15 MG was reported. By comparison, over 33 billion

Table 3.3: Projected Peak Wet Weather Flows through 2050 from DWSD First-Tier Customers

First-Tier Customer	2000 cfs	2010 cfs	2020 cfs	2030 cfs	2040 cfs	2050 cfs
Allen Park	7.1	7.1	10.6	10.6	10.6	10.6
Center Line	9.0	8.7	8.6	8.5	8.6	8.7
Clinton-Oakland	113	122	127	132	136	140
Dearborn	100 + 10-Yr Storm	100 + 10-Yr Storm	100 + 10-Yr Storm	100 + 10-Yr Storm	100 + 10-Yr Storm	100 + 10-Yr Storm
Dearborn Heights Dist. 2	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm
Evergreen-Farmington	170	170	170	170	170	172
Farmington	8.1	7.8	7.8	7.9	7.9	7.9
Grosse Pointe	192	192	192	192	192	192
Grosse Pointe Farms	554	554	554	554	554	554
Grosse Pointe Park	84	84	84	84	84	84
Hamtramck	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm
Harper Woods	1.4	1.4	1.4	1.5	1.5	1.5
Highland Park	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm
Macomb	177	211	234	258	270	283
Melvindale	11	10	10	10	10	10
N.E. Wayne	127	127	127	127	127	127
NHV/RV*	380	380	380	380	380	380
Redford Township	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm
S.E. Oakland	260	260	260	260	260	260
Wayne Co Area 6	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm	10-Yr Storm

Peak flows based on the 10-year allowable standard developed by SSO Work Group. In some cases the current or projected flows exceed the values listed as the peak wet weather flows to DWSD. See Flow Needs Tech Memo for description of alternative that assigns additional capacity for several communities with SSO or other water quality protection needs.
Grosse Pointe Farms and NE Wayne should be reviewed after 2010 based on progress on sewer separation and SSO controls.
*The values for North Huron Valley/Rouge Valley (NHV /RV) are calculated without Western Township Utility Authority (WTUA) communities --

gallons of combined sewer overflows (CSO) were reproted during the same period.

The total annual volume of SSOs from the system is very small compared to the annual CSO volume (the total reported SSO volume over the last two years was 0.12 percent of the total reported CSO volume).

Wet weather SSOs in the DWSD system are not primarily the result of limited transport capacity, but the result of rainfall dependent inflow and infiltration (RDII) in excess of original design expectations.

Footing drain inflow is one of the greatest causes of RDII, especially from areas with homes built between 1950 and 1980.

In areas built before 1950 and in sanitary systems originally built as combined systems, sources other than footing drains, such as connected downspouts and unidentified connections missed as part of the disconnection program, are a significant contributor to SSOs.

In wet weather, the DWSD regional system will reach capacity in most pipes during a storm with a return frequency of about one month. Such a storm provides about 0.5 inches per hour of rain, and this will yield 0.25 inches of runoff. Much of the trunk and interceptor system was designed to carry 0.25 inches per hour.

Based on these conclusions it is recommended that Detroit accept flows into the regional system up to an "allowable 10-year, 1-hour flow" for each customer. The "allowable 10-year, 1-hour flow" is the flow generated from a local collection system during the 10-year 1-hour design storm that conforms to criteria for peak hour flow to average daily flow for growth (summer) antecedent conditions and "best practices for system maintenance" developed by the Wastewater Master Plan and endorsed by the Contracts Work Group. Flows in excess of the allowable flow would need to be addressed by the individual community.

The MDEQ SSO policy of December 2002 uses the 25-year, 24-hour growth (summer) design event as the level of SSO control. The regional analysis found in most cases that the regional system can handle flows to the 10-year, 1-hour design event under growth (summer) conditions.

Local and regional cost comparisons for the six case study communities are presented in Table 3.4. Regional Alternative "A" increases customer community contract capacities to a technical standard based on the 10-year 1-hour storm flow and the age and type of the collection system. Regional Alternative "B" increases several customer community contract capacities to a flow rate greater than the technical standard established in Alternative "A" based on further optimization of system capacity.

Table 3.4: SSO Control Alternatives (millions of dol-

Community	Local Storage	Source Reduction	Alt. A	Alt. B
Allen Park	24	8-31	23	15
Center Line	20	22	15	13
Clinton Twp.	32	21	26	NA
Fraser	16+	17+	11	10
Garden City	33	68	NA	NA
Melvindale	22	46	5	2-4

3.5 Wastewater System Infrastructure

3.5.1 Sewer Infrastructure

DWSD owns and maintains about 15 percent (3,383 miles) of the pipes within the service area (See Table 3.5). The suburban communities own and operate about 35 percent of the pipes. The remaining 50 percent of the pipes are on private property.

DWSD has cleaned and rehabilitated 90 miles of pipe since 1982. See Table 3.6.

During inspections performed for this Master Plan, a total of 75 sewer pipes are classified in four categories: Excellent, Good, Fair, Needs Investigation. These classifications are defined as follows:

Excellent – Pipe is clean, fully functional, structurally sound, properly aligned, service connections intact and no evidence of corrosion or cracking. These pipes have 100 percent of their useful life remaining.

Good – Pipe is free of obstacles and noticeably clean, but may show some locations of slight cracking. No open joints are evident and most sections are properly aligned. Service connections are reasonably intact, and little or no evidence of corrosion appears. These pipes may have 75 percent of their functional life remaining.

Fair – Minor to moderate infiltration is occurring. Some evidence of corrosion may be seen on the pipe walls. Cracks have opened enough to allow roots to penetrate. Settling in the pipe allows sedimentation to build which is slightly reducing the capacity. These pipes will need to be inspected again in 10 years and have 50 percent or less of their useful life remaining.

Table 3.5: DWSD Owned & Maintained Sewers

In Detroit	3,344 miles
Interceptors Outside Detroit	39 miles
Total	**3,383 miles**

Table 3.6: DWSD Pipe Cleaning and Rehab Since 1982

Contract	Duration	Footage	Miles
CS-1368	Jul 02 - Apr 03	159,441	30.2
CS-1325	Sep 99 - Sep 02	177,710	33.7
CS-1256	Aug 96 - Aug 99	42,540	8.1
CS-1215	Apr 93 - Apr 97	28,832	5.5
CS-1164	Apr 92 - Dec 93	23,436	4.4
CS-1068	May 88 - Jun 92	36,116	6.8
CS-968	Jun 85 - Dec 88	4,732	0.9
CS-909	Apr 82 - May 83	2,250	0.4
Total		**475,057**	**90**

Needs Investigation – There are two situations within this classification. In the first situation, structural cracks appear in two out of every three sections of pipe. Cracks and joints are noticeably allowing exfiltration and infiltration. These pipes need to be replaced or repaired within 10 years and will need to be carefully monitored in the interim period.

In the second situation, an occasional obstruction may be reducing the pipe capacity by 25 to 50 percent. Parts of the pipe wall may be missing. Corrosion is so severe that the core of the pipe wall is visible, and collapse may be imminent. Repair/replacement needs to be planned immediately.

Table 3.7 on the following pages lists location, location, size material type, age, length and condition of DWSD sewers that were inspected physically and through a pilot televising program.

Condition percentages for those sewers that were physically inspected are shown in Table 3.8.

Seventy-five percent of the City of Detroit's sewer system is over 50 years old. Inspection and assessment of the infrastructure is needed for continued sustainability of the system. As the sewer system ages more rehabilitation is required to maintain the same level of service.

Table 3.7: Pilot TV and Physical Inspections of DWSD Sewers

Location	Size	Material Type	Age	Length (feet)	Condition
Between Chapel & Bentler/N. of Florence	18"	Clay	1928	244	Excellent
Between Chapel & Bentler/N. of Florence	18"	Clay	1928	316	Fair
2nd Str North of Michigan Ave.	3'-2" x 4'-9"	Brick	1905	416	Fair
Between Stahelin & Brace at Belton	15"	Clay	1928	302	Fair
Alley between 15th & 16th and North of Poplar	15" x 20"	Brick	1883	270	Fair
Trumbel & Sycamore	3'-6" x 4'-8"	Brick	1872	889	Fair
Between Pennington & SanJuan at Pickford.	12"	Clay	1925	346	Fair
Between Lyon & Keller at Dearborn	18"	Cast-in-place	1982	416	Good
N. of Waveney between Philip & Manistique	10"	Crock	1920	406	Good
Between Birchcrest & Fairfield at Margareta	12"	Clay	1921	369	Good
In Waveney between Barham & Wayburn	48"	Brick	1925	602	Good
N. of Waveney between Philip & Manistique	10"	Crock	1920	255	Good
Between Melville & Lyon at Leigh	15"	Cast-in-place	1982	187	Good
Between Melville & Lyon at Leigh	15"	Cast-in-place	1982	144	Good
Between Birchcrest & Fairfield at Margareta	15"	Clay	1921	250	Good
Between Stahelin & Brace at Belton	12"	Clay	1928	348	N.I.[1]
Between Pennington & SanJuan at Pickford.	15"	Clay	1925	346	N.I.[1]
Alley between 15th & 16th and North of Poplar	15" x 20"	Brick	1883	195	N.I.[1]
Between 24th & 23rd Ave. along the Park	10"	Vitreous Clay	1958	84	N.I.[1]
Dexter Ave between Monterey & Cortland	4' 0" x 6' 0"	Brick	1920	560	Excellent
Ashton between Rosemont & Fitzpatrick	24"	Concrete		250	Fair
Pembroke between Avon & Greenview	15"	Rein. Concrete	1930	314	Fair
Belton between Vaughn & Evergreen	18"	Concrete	1928	100.9	Fair
Belton between Vaughn & Evergreen	18"	Concrete	1928	198	Fair
Between Warwick & Artesian @ Joy	18"	Crock	1928	360	Fair
W. Chicago Ave between Evergreen & Plainview	24"	Crock	1928	162	Fair
Davison between Bentler & Chapel	15"	Concrete	1930	260	Fair
Minoch at Fenkell	18"	Concrete	1928	344	Fair
Kendall between Braille & Pierson	15"	Concrete	1928	357	Fair
Burgess Ave at Grand River	18"	Rein. Concrete	1940	237	Fair
Trinity Ave at Santa Clara	20"	Concrete	1929	155	Fair
Plymouth Rd between Chatham & Outer	15"	Rein. Concrete	1928	364.5	Fair
West Parkway Ave at Verne	18'	Vitreous Clay	1929	298	Fair
Sturtevant Ave between Petosky & Holmer	12"	Crock	1939	297	Fair
Clarita between Fairfield & Muirland	22"	Crock	1919	289	Fair
Hamilton between Richton & Monterey	12"	Crock		292	Fair
Second Ave between Puritan & Moss	18"	Vitreous Clay		271	Fair
Fullerton at Mansfield	42"			138.6	Good
McNichols from Biltmore to St Mary's	4' 6"	Clay	1927	890	Good
Thatcher Ave at Forrer	24"	Rein. Concrete		284	Good

[1]NI= Needs Investigation

Table 3.7: Pilot TV and Physical Inspections of DWSD Sewers (continued)

Location	Size	Material Type	Age	Length (feet)	Condition
Santa Maria between Asbury Park Ave & Murray Hill	18"	Rein. Concrete	1927	359	Good
Santa Maria between Asbury Park Ave & Murray Hill	20"	Rein. Concrete		206	Good
Pembroke from Faust to Ashton	48"	Brick	1929	723	Good
Sawyer near Braile Ave and Spinoza	12"	Vitreous Clay		423	Good
Acacia between Plainview & Auburn	12"	Crock	1928	381	Good
Glenco Ave at Stout	3' 6"	Brick		480	Good
Burgess Ave at Grand River	20"	Rein. Concrete	1940	160	Good
Pierson Ave at Santa Clara	24"	Concrete	1937	284	Good
Pembroke between Evergreen & Vaughn	30"	Concrete	1950	309	Good
West Parkway Ave at Verne	15"	Vitreous Clay	1929	293	Good
West Parkway Ave at Verne	12"	Vitreous Clay	1929	305	Good
Sturtevant Ave between Petosky & Holmer	12"	Clay	1939	247	Good
Leslie Ave at Old Mill Place	2' 6" x 3' 9"	Brick	1922	469	Good
Burlingame at Cascade	2' 8" x 4' 0"	Brick		278	Good
Doris at Holmur Ave	3' 6"	Brick	1924	500	Good
Livernois between Oakman & Ewald Circle	15"	Crock	1919	450	Good
Livernois between Thatcher & Curtis	6' 3"	Brick	1925	552	Good
Hamilton between Richton & Monterey	10"	Crock		453	Good
Woodward between Tyler & Avalon	3' 0" x 4' 6"	Brick		323	Good
Wisconson at Florence	15"	Crock	1924	349	N.I.[1]
Fenkell between Ilene & Griggs	18"	Crock	1925	364	Good
W. Chicago between Stahelien & Brace	24"	Vitreous Clay		263	N.I.[1]
Davison at Forrer	36"			73	N.I.[1]
Plymouth Rd between Longacre & Rutland	24"	Crock		420	N.I.[1]
Santa Maria between Lindsay & Oakfield	20"	Vitreous Clay	1927	192	N.I.[1]
Midland between Ashton & Rosemont	8"	Vitreous Clay		635	N.I.[1]
Hessel Ave between Rosemont & Ashton	18"	Rein. Concrete	1930	104	N.I.[1]
Off Joy between Pierson & Braile	21"	Concrete	1930	148.3	N.I.[1]
Burt Rd at Davison	12"	Vitreous Clay	1927	474	N.I.[1]
Acacia between Plainview & Auburn	12"	Crock	1928	136	N.I.[1]
N. of Clarita between Plainview & Westmorland	18"	Vitreous Clay	1929	0	N.I.[1]
In Braile Ave South of 7 Mile Rd	24"	Rein. Concrete	1939	143	N.I.[1]
Holmer Ave between Clements & Grand	15"	Rein. Concrete	1919	198	N.I.[1]
Hamilton between Richton & Monterey	18"	Crock		67	N.I.[1]
Hamilton between Pilgrim & Midland	10"	Crock			N.I.[1]

[1]NI= Needs Investigation

Table 3.8: Condition of Inspected DWSD Sewers

Excellent condition, no work needed:	4%
Needs Light cleaning:	16%
Needs Heavy Cleaning:	45%
Needs Point Repair:	11%
Needs Rehabilitation:	24%

The pilot sewer inspection program found that 63 percent of the pipe inspected contained significant sediment deposits, debris backup, root intrusion, and degradation of pipe integrity.

Sediment buildup in the laterals and connectors must be removed to optimize sewer capacity. An estimated 50-55 cubic yard of sediment per mile is present. In a pilot project 41 of 48 sewer segments needed to have sediment removed prior to inspection.

Sediment buildup in the interceptors and trunk sewers was estimated in a pilot inspection program. Results from the pilot program indicated 1,500 cubic yards of sediment per mile of pipe inspected.

West Nile Virus was found in Detroit, and Wayne, Macomb, St. Clair and Oakland counties in 2002. According to the Centers for Disease Control and Prevention, *Suggested Guidelines for Phased Response to West Nile Virus Surveillance Data*, areas that have had West Nile Virus should apply larvicides to locations identified by an entomologic survey. Larviciding could involve many DWSD structures. Identification of the areas that should be larvicided could be determined by the Detroit City Health Department. DWSD personnel can help in the gathering of information by reporting dead crows and blue jays to the local health department.

3.5.2 Pump Stations

Detroit Water and Sewerage Department (DWSD) currently operates 22 individual pump stations. This number will drop to 21 when the Garfield Pump Station in Mount Clemens is closed. Of the 21 pump stations, seven are package stations on Belle Isle, and one (Lighthouse Point) has a capacity less than 1 million gallons per day. Therefore, there are 13 major pump stations operated by DWSD projected to be in continuous operation.

In December 2001, the Detroit Wastewater Partners, under contract to DWSD, conducted an inventory and evaluation of assets in the DWSD system called the *Asset Audit Report*. Included in the asset audit was an inventory of pump stations. The report was completed under PC-744, *Program Management for Wastewater Treatment Plant Rehabilitation and Upgrade*. The purpose of the asset audit is to assess the current and projected operational status of all significant system components, their state of repair condition, and their projected maintenance and replacement status. This Asset Audit will be updated every three years for the life of the contract, and will be completed in the future by DWSD staff at the same intervals.

A large proportion of the pump station assets found during the inventory are listed as being older than 20 years. Unfortunately, the *Asset Audit Report* does not list actual ages, so it is difficult to know how old the majority of components are. The significance of the age of the item will vary with they type of system evaluated. While most electrical and mechanical components will have a recommended maximum life of 20 years, building components typically last longer and may be replaced at longer intervals. Table 3.9 is a summary of the *Asset Audit Report* on pump stations.

Major rehabilitation projects were 41 percent of the total projects identified. In many cases (41 percent) immediate attention is required. Many of the repairs are electrical and mechanical (79 percent)

Table 3.9: Summary of Asset Audit Results for Pump Stations

Analysis	Category	% of Total
Size/ Complexity of Repair	Light	37
	Medium	22
	Major	41
Time Frame	Immediate	41
	Short Term	33
	Long Term	27
Type of Repair	Mechanical	42
	Electrical	37
	Structural/Building	21

instead of structural.

DWSD has already recognized the need for rehabilitation and replacement of critical pump station facilities and has been rehabilitating and replacing pump station components through its contracts. All of the pump stations except Brennan Pools have had either major pump rebuilds (2) or rehabilitation contracts (10) planned or underway in the past few years. Pump Stations Nos. 1 and 2 are also currently undergoing substantial assessment and rehabilitation under the PC-744 contract.

3.5.3 Meters

DWSD maintains a total of 65 major meters throughout its service area. Of these, 56 are important billing or flow-monitoring meters, seven are meters at the Wastewater Treatment Plant measuring incoming flow, and two measure final effluent. Meter types include parshall flumes, ultrasonic, magmeter, transit time, and weir installations.

Information on the age of the meters has been obtained from the DWSD billing meter staff and DWSD notes and publications, where available. The age of the meters varies from less than a year (some meters have been replaced under the program) to 57 years. At least half of the meters are older than 20 years, the expected maximum life of mechanical and electrical equipment. A large proportion of the meters listed with "unknown" age are suspected to be older than 20 years.

The condition information reflects recent problems noted and improvements made, but may not indicate current status, as many of the repairs needed have been made. No significant problems are noted with approximately 75 percent, or 49 of these meters. The rest require minor adjustments, or the need for repair and replacement is being documented under the CS-1249 project. Through the CS-1249 (Greater Detroit Regional Sewer System Amendment 4) project, CDM is monitoring, maintaining, and evaluating these meters as part of an ongoing program to upgrade the billing system.

3.5.4 Other Wastewater System Facilities

Other wastewater system facilities such as outfalls, flow regulators, backwater gates, dams, and in-system storage facilities were previously catalogued under the Long Term CSO Control Plan. Inspection and rehabilitation of some of these facilities was completed under contracts CS-1053, CS-1158, PC-695, and PC-698. A summary of the inspections is shown in Table 3.10. Individual inspection results are listed in Table 3.11.

Outfalls are generally box sewers leading from flow regulators and/or dams to the Detroit or Rouge Rivers. There are 81 outfalls in the DWSD system (including outfalls at pump stations). Of these, 42 outfalls were inspected under previous contracts in 1988 and 1995. Some outfalls have been rehabilitated under recent contracts.

Outfall flow regulators are flow control devices that control flow from trunk sewers into interceptors based on the wastewater level in the receiving interceptor. They divert sanitary flow during dry weather conditions to interceptors, and combined flow during wet weather partially to interceptors and the rest to river outfalls. There are 41 flow

regulators. Most of these were inspected in 1992-93 and rehabilitated in 1998.

Backwater gates are installed in CSO outfalls along the Detroit and Rouge Rivers. The purpose of backwater gates is to prevent water from the rivers from entering the DWSD collection system. There are a total of 54 backwater gates. Backwater gates were inspected in 1992 and 1995 and recommendations for repair made at that time.

Outfall dams are installed in the outfall between regulators and the river to prevent river water from entering the collection system. Dams are usually of fixed concrete construction. There are 55 diversion dams. Many of these were inspected with the outfall flow regulators in 1992.

There are four groups of in-system storage facilities: 1) 7 slide gates along the Rouge River; 2) 17 valve remotes operating system gates; 3) 13 new in-system storage devices to be installed for CSO storage; 4) 3 existing in-system storage devices (inflatable dams). Some of the older existing in-system storage facilities were inspected in the early 1990's and were rehabilitated in 1998.

Table 3.10: WW Facilities Inspection Results

	Rehabilitation Requirements			
	Long-Term	Mid-Term	Short-Term	Total
Outfalls	8	2	20	30
Outfall Flow Regulators	0	0	3	3
Backwater Gates	0	12	0	12
In-System Storage Devices & System Gates	1	1	2	4

Table 3.11: Outfalls and Backwater Gates Inspection Results

I.D. NUMBER	LOCATION
Outfalls	
Rouge River District	
B-54	Warren At Rouge River
B-59	Pulaski & Jefferson
B-63	W. Chicago & Rouge River (Outer Drive)
B-65	Fullerton & Rouge River (Schoolcraft)
B-69	Jeffries Fwy. & Rouge River (W. Parkway)
B-82	Glenhurst & Rouge River
B-85	7 Mile & Berg
B-87	Frisbee & Berg
Central District	
B-3	McClellan & Jefferson
B-5	Iroquois & Jefferson
B-6	Helen & Jefferson
B-8	Lieb (Harbortown)
B-14	Orleans & Franklin (West)
B-16	Riopelle & Franklin
B-18	Schweizer & Franklin
B-22	Griswold & Woodbridge
B-25	Cabacier & Jefferson
B-26	11th & Jefferson
B-27	12th & Jefferson (Rosa Parks)
B-28	14th & Jefferson
B-29	18th & Jefferson
B-30	21st & Jefferson
B-32	W. Grand Blvd. & Jefferson
B-33	Swain & Jefferson
B-34	Scotten & Jefferson
B-35	McKinstry & Jefferson
B-36	Summit & Jefferson
B-40	Campbell & Jefferson
B-41	Dragoon & Jefferson
B-42	Schroeder & Jefferson
B-47	Flora & Reisner
East Jefferson District	
B-1	Ashland (Fox Creek)
P-8, P-15	Freud Pump Station
Backwater Gates	
Rouge River District	
B-54	Warren & Pierson
B-56, 57, 58	Tireman & Trinity
B-75	Fenkell & Rouge River
B-82	Glenhurst
Central District	
B-10	Jos Campau & Franklin
B-17	Franklin & Rivard
B-19	Jefferson & Randolph
B-21	Jefferson & Woodward
B-22	Jefferson & Griswold
B-24	Jefferson & Third
B-45	Jefferson & Dearborn
B-24	Carbon & Rouge River

3.6 Policy, Practice and Regulations

Current and Emerging Wastewater Regulations

Current and emerging regulations have been reviewed with respect to how they will or may effect effluent limitations, siting for any new WWTP discharges, and other factors affecting DWSD into the future. The following regulations are likely to impact DWSD in the future:

- TDML requirements may result in more stringent wastewater discharge requirements (although proposed TDML regulations have recently been suspended pending federal review).
- CSO regulations may require the City of Detroit to provide treatment or storage of CSOs, including possible construction of additional projects.
- SSO regulations may require permits to be obtained by satellite communities. Part of the requirements for SSO control is the adoption of CMOM (Capacity, Maintenance, Operations, and Maintenance) practices to maintain and adequately operate sewer systems. CMOM rules are not applicable to combined sewer systems like Detroit's.
- Backups of the sewer system leading to basement flooding and other destruction of property have resulted in lawsuits throughout the state. Michigan PA-222 was adopted to regulate these disputes. This law requires that DWSD and other utilities to maintain the collection system to avoid property damage due to sewage flooding and to respond in a timely manner to any reported incidence of property damage due to flooding by sewage.
- The 1996 Safe Drinking Water Act (SDWA) amendments require states to develop programs for assessing potential contamination threats to the watersheds or groundwater protection areas of drinking water sources. Programs such as the Michigan Department of Environmental Quality's Source Water Assessment Program (SWAP), and the Source Water Protection Plan described in the 50-year Water Master Plan address the obligations of the SDWA. As a result of these source water protection programs, the impact of DWSD wastewater outfalls on downstream drinking water intakes must now be taken into consideration. There are applications/tools available that would empower DWSD to be proactive in supporting source water/watershed protection programs. These applications include total maximum daily load (TMDL) trading, water quality trading, net environmental benefits analysis (NEBA), and the new concept of watershed-wide permitting. Each of these applications can be integrated into source water/watershed protection as it relates to wastewater and drinking water treatment.

The recent MDEQ SSO Policy of December 2002 is likely to have the most immediate impact on planning decisions. Other current and emerging regulations continue the trend toward more stringent water pollution controls.

System Expansion Policy

In 1998 DWSD established a System Expansion Policy that is based on the principal of "growth pays for growth." This policy ensures that all new expansion of the system is financially feasible and does not result in the subsidy of urban sprawl.

The specific procedures for implementing this broad policy for all customers have yet to be finalized, but the policy has been applied to specific requests from individual wholesale customers. Currently, DWSD makes decisions to accept new requests for capacity through a three-step process that includes:

- Independent engineering confirmation of the projected flows being requested by the wholesale customer;

- Analysis of the transport and treatment capacity of the system to accept the new flows; and
- Negotiations with the wholesale customer regarding connection costs and rates for transport and treatment.

Wholesale Contracts

The city's wastewater service contracts were reviewed from the perspective of changes that may be required to support the Master Plan. Many of the current contracts for wastewater service were originally developed over 50 years ago, and there are a great variety of terms and conditions that are unique to particular customers. The lack of uniformity presents a challenge to Master Planning, particularly:

- Different lengths of term of service
- Different types of flow limits (some reference 0.4 cfs/1,000 persons without quantifying a maximum flow rate)
- Ownership, access authority and maintenance responsibilities for specific facilities are not uniformly addressed
- Enforcement of penalty provisions, where these exist, are variable
- Various billing intervals

The Wastewater Master Plan will be best supported by contracts that have standard provisions with specific flow limits and terms of service.

DWSD has formed a Contracts Work Group that includes its first-tier wholesale customers. This work group plans to develop a new model contract in early 2004 that considers flow-based and capacity-based cost allocations and rates.

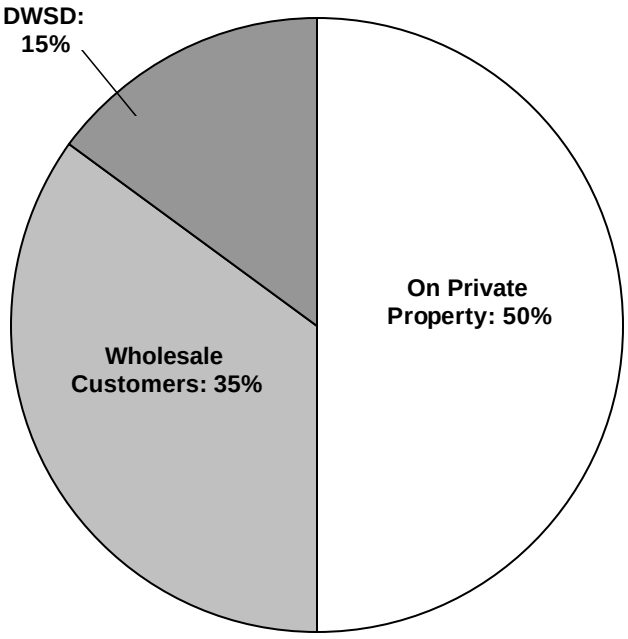
3.7 Facilities on Private Property

Facilities on private property include on-site sewage disposal systems and service connection pipes. These facilities have been identified as critical facilities because of their number – over 1.5 million service connections to the DWSD regional system and over 133,000 on-site sewage disposal systems in the septage service area.

The total length of private service connections is about one half of all the pipeline connected to the wastewater treatment plant. Pipe ownership is shown in Figure 3.6.

Individual property owners have a major role in accountability for regional wastewater service costs. Proper installation and maintenance of these facilities can keep public costs for wastewater collection and treatment at a minimum.

Figure 3.6: Pipe Ownership in the DWSD Service Area



One significant source of pollution within the control of DWSD and the city was investigated in this Master Plan: septic systems with the city limits discharging to the Rouge River. Elimination of septic systems in Detroit is one example of an environmental policy that can add new customers to the system as well as reduce pollution of local rivers. Investigations for this Master Plan identified a list of 27 addresses of these possible on-site sewage disposal systems.

A review was made of the conservation soil maps of four counties (Oakland, Macomb, St. Clair and Lapeer) to determine soil suitability for OSDS. Soils were rated suitable, marginal, unsuitable and unclassified.

By 2050, over 140,000 people living in communities that now rely on OSDS may need DWSD sewer service. See Figure 3.7 on the following page.

3.8 Wastewater Service Alternatives

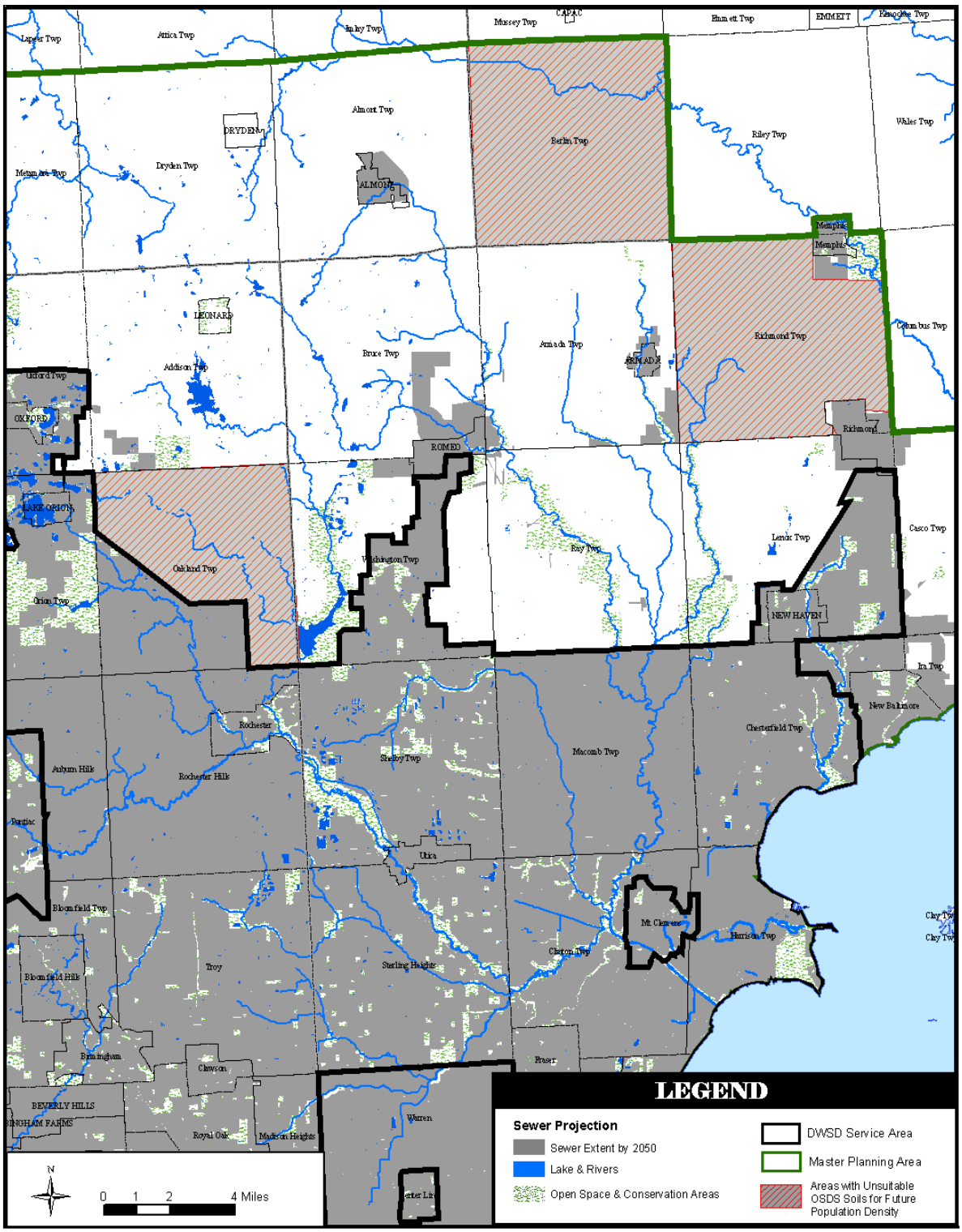
Average dry weather flows within DWSD's sewered area are expected to increase from 605 mgd to 635 mgd over the next 50 years. This projection includes flows from the Western Wayne Townships Utilities Authority (WTUA). These flows will probably be transferred to the Ypsilanti Communities Utilities Authority wastewater treatment plant in 2006. The magnitude of the transferred flows will increase from 15 mgd in 2006 to 21 mgd in 2050, resulting in a decrease in projected 2050 flow at the Detroit wastewater treatment plant to 614 mgd. This shift in flows is shown in Figure 3.8, which shows current and projected planning area dry weather flows by decade. Maximum daily flows that will require secondary treatment are expected to increase from 757 mgd in 2000 to 789 mgd in 2050. Current and projected Planning Area dry weather flows by decade are shown in Figure 3.8.

The construction of new satellite treatment plants and the expansion of existing plants operated by other wastewater service providers were evaluated. Satellite treatment is a feasible option. However, on a unit-of-flow basis, the cost of satellite treatment is two to three times as expensive as expansion of facilities in Detroit. The higher costs of satellite treatment are due to more stringent effluent requirements and costs to change the interceptor and pumping system to convey flows to the expanded plants. Small increases in the capacity of some satellite plants may be cost-effective where major conveyance system changes are not required.

Certain elements of each conceptual alternative are feasible and cost-effective. These optimal elements need to be adopted by DWSD in a time line as follows:

- Proceed with flow management efforts immediately, and pursue these as a continuing effort

Figure 3.7: ODSD Areas That Will Need Sewers by 2050.00



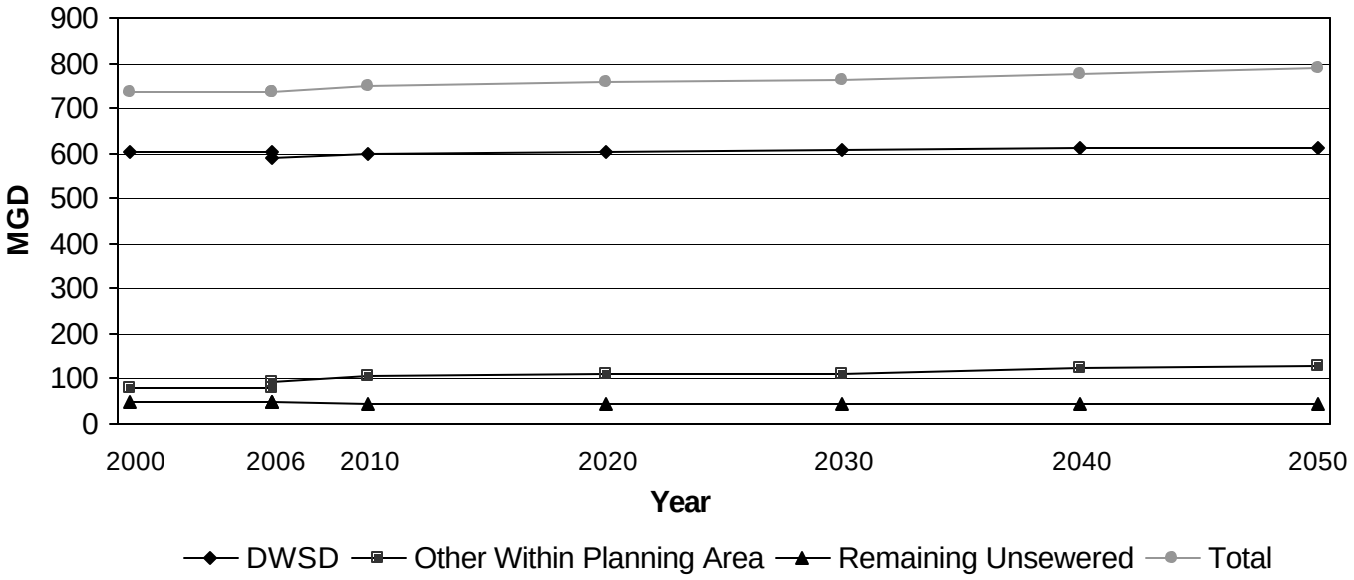
through the planning period.

- Wait until 2007 or later, when major CSO and SSO basin dewatering flows are a reality, and determine if additional wet weather flow treatment is needed.
- Should flows increase beyond the projections in this plan, or should other treatment providers in the planning area need to abandon their plants, consider expansion of existing treatment facilities located near the existing plant, but at a separate site.
- Provide existing customers and other providers information regarding DWSD rate projections for 10 years so that wholesale customers can make informed decisions on the cost-effectiveness of new satellite facilities

DWSD can provide wastewater service to most communities in the planning area at costs that are lower than the cost of individual communities building or expanding their own treatment plants. This is the case because the DWSD system is large and has secondary treatment capacity requirements, while other plants on the Huron, Rouge, or Clinton rivers require tertiary treatment. However, communities are concerned about the rate of increase of DWSD sewer rates, the complexity of contracting with the DWSD, and the need to also contract with an existing first-tier or second-tier customer. For these reasons, communities may choose service from other treatment providers in the planning area.

The Pontiac and Mt. Clemens wastewater treatment plants have the greatest potential for expansion to serve more communities in Oakland and Macomb counties. Oakland and Macomb counties each have studies ongoing or proposed to look at the cost-effectiveness of expanding these plants. Preliminary engineering performed for this Master Plan indicates that major expansions that involve new interceptors would be more costly compared to the cost of DWSD service today. Any study of cost-effectiveness needs to consider anticipated rate increases by the DWSD. Projections of future sewer rates are addressed in Volume 5, *Customer Service and Technical Support Program*.

Figure 3.8: Planning Area Dry Weather Flow Projections



3.9 Long Term CSO Control Plan

Numerous CSO storage facilities have been built in the service area, and additional facilities are proposed. In total, there will be about 950 million gallons of stored CSO or other wet weather flows by 2012. The DWSD Long Term CSO Control Plan has recommended that the stored flows be dewatered and treated at the wastewater plant. Further analyses conducted for the Wastewater Master Plan confirm that dewatering of these facilities can be accomplished within the desired 24- to 72-hour time frame with the NPDES permit provision that allows for primary treatment of some wastewater flows under specified wet weather conditions.

The next update of the long term CSO plan in 2008 will identify future requirements for CSO controls for the Detroit River and other updates to the long-term plan.

The cost estimates developed by the Long Term CSO Control Plan project include costs to plan, design and construct new CSO facilities. This master plan has identified future costs for rehabilitation of structures and replacement of equipment for CSO control facilities. This master plan has also included costs for additional staffing to operate the new CSO facilities. All of the costs for planning, design, construction and operation over the next 50 years are included in the estimates of future revenue requirements in the long term CIP and O&M costs.

3.10 Wastewater Treatment Plant and Biosolids Management

3.10.1 Liquid Treatment Train

The current upgrade at the wastewater treatment plant (PC-744) is expected to meet NPDES permit requirements for primary treatment of wet weather flows in excess of secondary treatment capacity by 2007. After 2007, the major new source of flows at the wastewater treatment plant will be the flows from the dewatering of planned CSO storage basins, plus possible flows from new SSO storage basins. When these new flows are on-line, a number of factors need to be reviewed to determine if additional treatment of wet weather flows is needed. These factors include:

- Experience with dewatering of CSO and SSO storage basins;
- Operational data on the performance of flow blending at the wastewater treatment plant.

Expansion of the wastewater treatment plant at the existing site is difficult because of space limitations and the configuration of the existing process layout. Flow projections for this Master Plan show that a major expansion would not be necessary if recommended flow management actions are successful. By the end of the planning period, the new facilities under construction will be over 40 years old, and the oldest elements of the plant will be over 100 years old. This Master Plan has prepared a conceptual design for a reconstruction of the plant at its existing site by the end of the planning period. This conceptual design provides for the newest and most efficient technologies and will enhance operational flexibility and reliability.

3.10.2 Biosolids

The current Detroit Wastewater Treatment Plant solids treatment processes include gravity thickening of the primary and secondary sludge, dewatering using belt filter presses (BFP) and centrifuges, and multiple hearth incineration (MFH) or

landfill disposal of the dewatered sludge.

The disposal of sewage sludge is regulated primarily by federal EPA Part 503 regulations and the Clean Air Act, and Michigan Part 24 regulations. Key elements of the regulations are summarized and future trends are discussed in the technical memorandum *Long Term Solids Disposal Alternatives for Detroit Wastewater Treatment Plant*.

Solids disposal technologies, both proven and emerging ones, were reviewed. A total of nine alternatives (in addition to beneficial reuse) were selected for evaluation. These nine alternatives are developed around our understanding of issues in three key areas: the project framework, the capacities needed, and the space and land availability at the WWTP. These nine selected alternatives were evaluated and ranked per the criteria established for DWSD, and the final two alternatives were selected and recommended for further evaluation.

Should the Minergy project not proceed as planned, DWSD should review alternatives identified in this plan. A phased decision making process is also recommended as a means to update these alternatives while also considering new future technologies and assessing the long-term viability of beneficial reuse. (Minergy / Synagro).

The final conclusions are:

1. The most appropriate long-term alternatives for further evaluation are upgrade of the multiple hearth incinerator facility (Alternative 4) and installation of a new fluidized bed incinerator system incorporating energy recovery, with a lime mixing facility as a backup (Alternative 5).
2. The DWSD can benefit from new technology development using a phased decision making process to evaluate these technologies at each update of its Solids Master Plan.

Anaerobic digestion would warrant further evaluation as a core processing technology if DWSD elects to replace the existing wastewater treatment processes with new facilities.

3.11 Capital Improvement Program and Financial Planning

The Detroit Water and Sewerage Department is a department of city government, although it is managed as a separate enterprise fund. Both the operating budget and capital improvements program (CIP) of DWSD are approved by the Board of Water Commissioner and Detroit City Council. DWSD's capital improvement program (CIP) is developed for five years at a time, based on requests from divisions of DWSD. The proposed CIP is reviewed by an internal management committee and presented to the public and City Council through public hearings. Each year, the rates are developed by DWSD staff and consultants based on the approved operating budget, CIP, and revenue requirements and projections. DWSD also sponsors a Rates Work Group to review the wastewater rates as they are formulated. The Rates Work Group membership is made up of first-tier customers who have expressed interest in rates and CIP development.

Financial planning was performed as part of this Master Plan to evaluate the impact of the recommended improvements (CIP) and management programs on DWSD 's future revenue requirements and future wholesale and retail rates. The financial plan presented in the Master Plan takes into account the recommendations of the Master Plan. It accounts for the Department's obligations to abate combined sewer overflows, complete renovation and ongoing maintenance of wastewater facilities, and meet outstanding debt obligations.

- A 50-year CIP to carry out the programs of the Master Plan was developed by:
- Identifying future projects required for system maintenance and expansion;
- Developing a range of cost estimates for the required improvements;

- Determining a schedule for the improvements for the 50-year period, based on an engineering evaluation of when these improvements might be needed; and
- Calculating and upper range and lower range for the CIP to use in rate modeling.
- Future O&M (operations and maintenance) needs were also estimated.

The Master Plan has assessed the Department's infrastructure needs over the next 50 years. The CIP includes improvements to the existing collection system as well as the treatment and CSO facilities. The CIP ranges from between $13.5 to $16.1 billion over 50 years depending on the chosen level of annual replacement and renewal. These capital expenditures will place a significant financial burden on the Department as well as the City of Detroit and the wholesale suburban customers.

Overall, the revenue requirement is projected to increase from $335 million in FY2004 to between $2.2 and $2.5 billion depending on which CIP alternative is chosen. A significant amount of these expenses will be incurred in early years, which results in average annual rates at which costs are projected to increase of 8 percent on average. However, in the long run, the impact of the CIP will be mitigated by the long implementation timeframe of the CIP and the advantages of replacing expiring debt with newly issued bonds.

The comparison of the two CIP ranges and their respective effects is shown in Figure 3.9.

Over the 50 years implementation timeframe, the revenue requirement for the Department is projected to increase by between 4.1 and 4.3 percent depending on the exact cost alternative chosen. However, the exact rate of increase is highly dependent on the assumptions used, the overall economic environment, and the timing of the CIP projects. The timing of the increases is heavily front-loaded with the required increases much larger in the early years than later years. In addition, the increase for the City of Detroit customer base will be higher than those anticipated for the suburban customer base.

Figure 3.9: Revenue Requirements, Upper vs. Lower Range

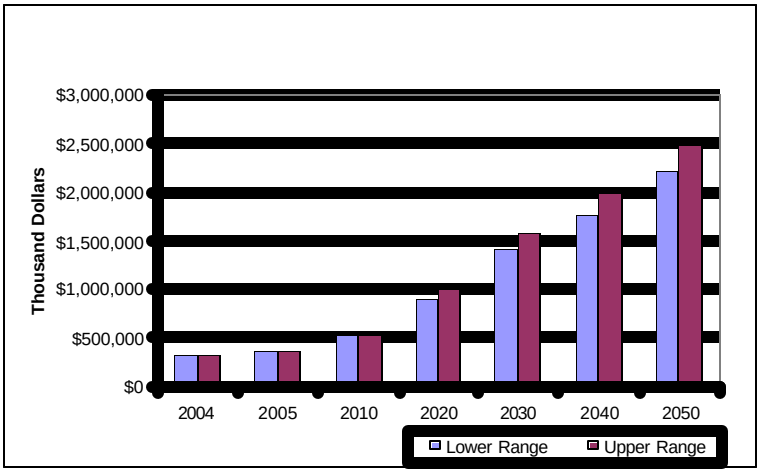
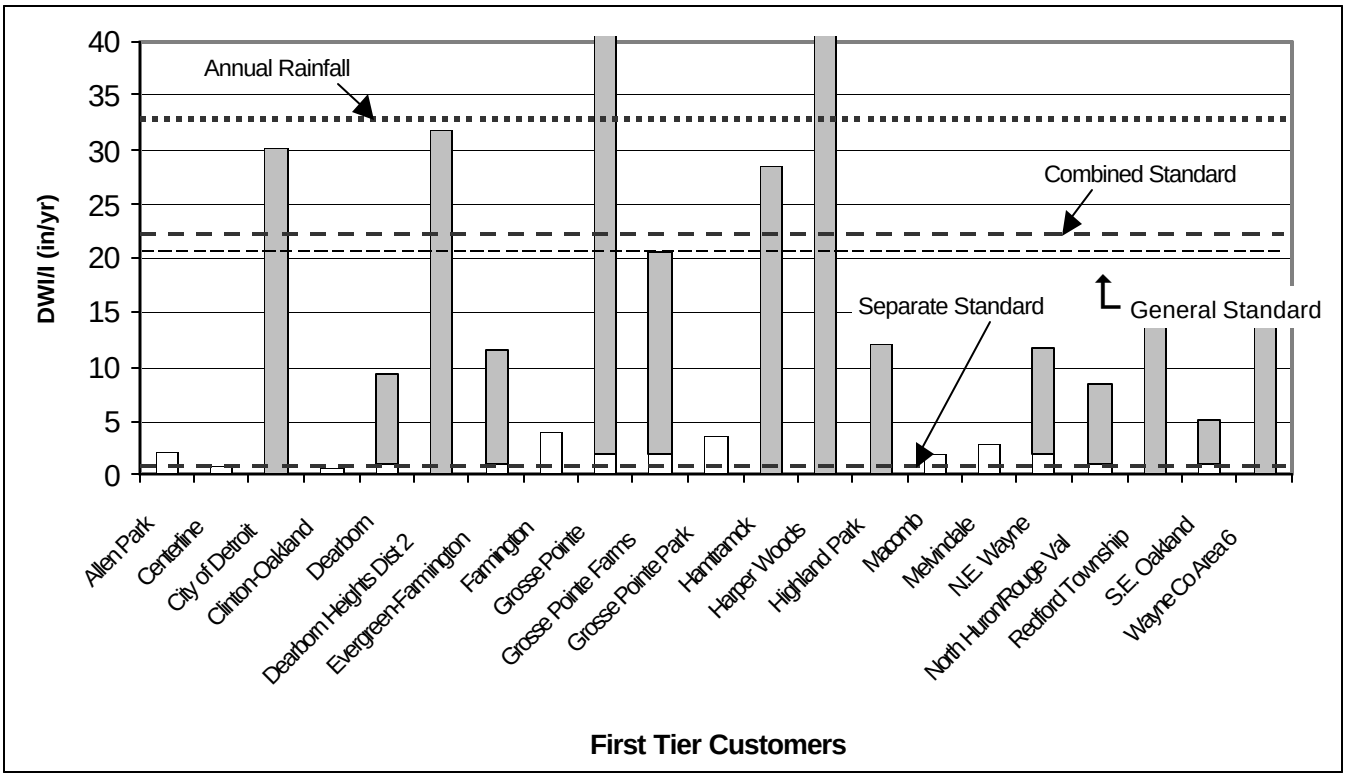


Figure 3.10: General Standard and System-Specific Comparison



3.12 Flow Management

Detroit and a number of communities in the DWSD service area are performing projects to reduce sources of excessive infiltration/inflow. These efforts, along with trends in residential and industrial water conservation show that DWSD can manage flows within its existing treatment plant capacity. A detailed examination of dry weather and wet weather infiltration/inflow rates was performed to develop target reductions for dry weather infiltration/inflow by community.

Capacity management in the context of this Master Plan includes the reduction of I/I and the optimization of wet weather flow routing to maximize the use of available capacity. At present, dry weather flows at the treatment plant are an estimated 40 percent infiltration and inflow. The Volume 1 *Report on Planning Criteria* established that dry weather infiltration/inflow was about 212 mgd in 2001. Dry weather sanitary flows due to new growth are expected to increase by about 30 mgd after new residents and employment are added to the planning area by 2050.

Dry weather infiltration/inflow sources should be eliminated when the cost is $5 or less for each "gallon per day" of flow removed on a 20-year present worth basis. Types of sources that fit this criteria include:

- Storm sewer connections to sanitary sewers
- Catch basin connections to sanitary sewers
- Residential footing drains
- Abandoned but flowing water services

Additional consideration should be given to restoring urban streams in Detroit, thereby diverting urban runoff from combined sewers to open streams. If feasible, this could improve water quality through reduction of combined sewer

overflows and through natural processes of sunlight and aquatic processes. The recreation of riparian habitats for wildlife and plants would beautify neighborhoods and be a focal point for neighborhood revitalization.

Figure 3.10 shows opportunties for flow management within DWSD's wholesale customers. Some customers have dry weather infiltration/inflow rates that are close to or exceed annual rainfall. This indicates that water mains leakage or direct inflow from streams is entering the collection system

3.13 Human Resources

The Master Plan included a performance benchmarking assessment that provides comparable information gathered from other wastewater service providers or utility standards. The following areas were part of the benchmarking task:

- High-level metric benchmarks (i.e. costs per gallon of sewage)
- Collection System and Capital Improvement Projects
- Human resources
- Wholesale sewer customer relations

The assessment also looked at some of the information on a trend basis. Overall, the objective was to provide evidence on the competitive position held by DWSD. The main focus was on wholesale customer relations in light of the increased work on the contractual issues between DWSD and its first- and second-tier customers.

Overall, DWSD falls within the range of expense and operations parameters compared to the sample wastewater utilities group.

The wastewater wholesale provider sample group includes the following utilities:

- MSD - Metropolitan Sewerage District, Cincinnati, Ohio
- WSSC - Washington Suburban Sewerage Commission, Baltimore, Maryland
- Chicago - City of Chicago Sewer Department, Chicago, Illinois
- MCES – Metropolitan Council Environmental Services, St. Paul, Minnesota
- MWRA - Massachusetts Water Resources Authority, Boston, Massachusetts
- WASA - Washington Area Sewerage Agency,

Figure 3.11: DWSD Yearly Wastewater System O&M Cost, 1997-2001

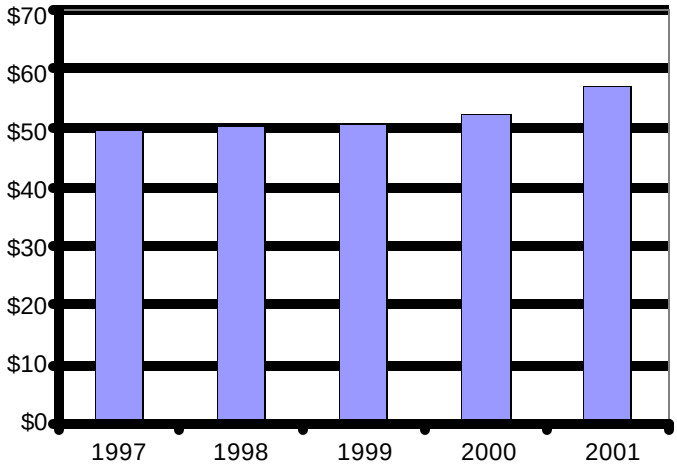
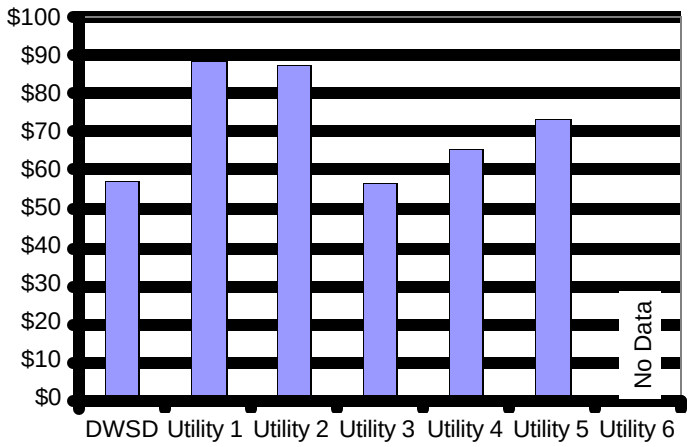


Figure 3.12: Comparison of Wastewater System O&M Cost Per Capita



Washington, District of Columbia

Based on the obtained information, the following conclusion were developed:

- Overall, DWSD falls within the range of expense and operations parameters when compared to the sample wastewater utilities group.
- Total cost increases have been moderate but relative costs (expenditures per flow unit) have been increasing more rapidly.
- DWSD has had elevated employee turnover over the last several years. An emphasis should be placed on correcting this trend in order to avoid excessive hiring and training expenses in the future especially in light of the magnitude of the department's labor costs.
- In regard to the system maintenance and improvement categories, DWSD finds itself within the average of the comparables group. Nevertheless, going forward, a continued effort should be placed on system rehabilitation initiatives.
- DWSD can make improvements in regard to wholesale customer relations practices. An emphasis should be placed on the development of a standardized contractual agreement and continued use of the wholesale customer steering committee for policy advice.

Three examples of benchmarking results are presented here.

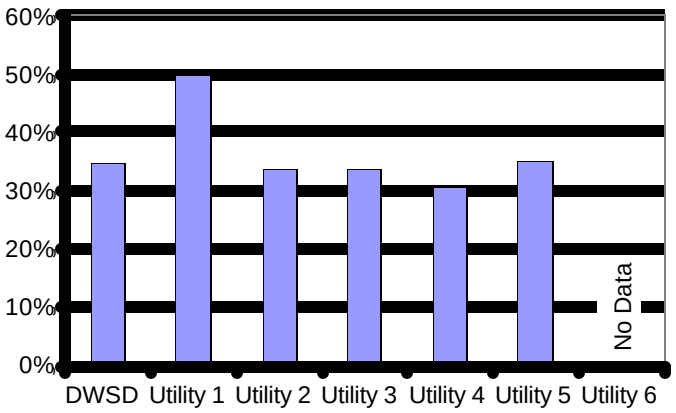
DWSD's costs of operations and maintenance (O&M) expenses per population served have risen from 1997 to 2001 by an average annual rate of nearly 4 percent. See Figure 3.11.

However, DWSD provides its wastewater service at a cost per capita at the lower end of the comparable wholesale utilities. This information is provided in Figure 3.12.

DWSD has labor costs that take up close to 35 percent of total O&M expenses as illustrated in Figure 3.13. The level of these costs is approximately in line with the comparable utilities group. However, these costs are significant and a clear driver of the overall operating costs incurred by the department.

The labor-management environment that exists upon completion of Master Plan capital projects may well have as much impact on the ultimate

Figure 3.13: Labor Cost as a Percentage of Wastewater System O&M Cost



performance and success of those projects as the physical or technical systems themselves. The cultivation and development, over the long term, of a favorable labor-management climate is critical to DWSD's success.

Human resources policy is administered by the City of Detroit Department of Human Resources, not by DWSD. Contemporary HR Information Systems are essential for improving organization performance. HRIS functions particularly important to DWSD include staffing planning, development planning, and succession planning.

As organizational performance increases, the workforce does more with the same or fewer numbers. The existing staff, however, becomes more critical to the operation. It will be vital to DWSD as the Master Plan unfolds to recruit and hire those critical skills necessary for managing, operating or maintaining more sophisticated, complex technologies.

3.14 Asset Management and Information Technology

DWSD has begun to develop asset management tools that will be beneficial in improving operational efficiency for its rehabilitation and replacement of equipment at its wastewater treatment plant and in its collection system. These tools can be expanded and coordinated with the CIP planning process using GIS data and systems developed under this Master Plan.

As with any long term Master Plan, the basis of the planning effort is information. The DWSD Wastewater Master Plan established a project GIS and relevant data management applications. In this area, the following was accomplished:

Procured and installed project computer systems;

Developed specifications for transmitting electronic data from DWSD to the project;

- Analyzed and recommended GIS tools for use in the project and ultimate use by DWSD;
- Recommend prerequisite training for software products;
- Specified and procured base map and demographic data;
- Obtained and converted the existing data on the DWSD collection and interceptor systems; and
- Obtained and integrated the DWSD GDRSS model data into the project system.

The Master Plan required the use of a system-wide sewer model to analyze the impacts on the DWSD service area in the year 2050. To accomplish this, the Master Plan was constructed from the existing DWSD GDRSS model established in late 1998 (Baseline). Updates to the GDRSS model were made in 2001 and this version became the Wastewater Master Plan model.

Other important steps to improve operational efficiency of the regional system include:

- The development of new uniform contracts with customer communities, as discussed in Section 3.6
- The completion of the Regional Operational Plan for DWSD and its first-tier customers, and annual updates to this plan
- The development of a coordinated five-year and 10-year CIP for sewer infrastructure, as discussed in Section 4.

4. Recommended Implementation Actions

4.1 Planning Intervals and Future Updates to the Master Plan

The following actions are recommended to implement the DWSD Wastewater Master Plan. These recommended actions are essential steps for DWSD to take over the next five decades. The 50-year planning period has been divided into three planning intervals as shown in Table 4.1.

This plan recommends actions for each planning interval. Recommendations for the Early Period from 2004 to 2015 are the most definitive and detailed. Recommendations for the Middle and Late Periods are more general, and these later recommendations should be reviewed and updated by DWSD as new information becomes available.

The DWSD should make updates to this Master Plan at 10-year intervals and integrate its Master Planning and CIP processes so that the future Master Plans establish a 10-year capital improvement program for the regional system. Such a 10-year CIP for July 1, 2003, to June 30, 2012, is provided in Table 4.2.

An integrated Master Plan and regional CIP for the regional system on a 10-year interval will enhance operational efficiency with coordinated wastewater planning, financing and construction in the region.

Table 4.1: WWMP Planning Intervals

Planning Interval	Dates (Fiscal Years)
Early Period	2004 to 2015
Middle Period	2016 to 2030
Late Period	2031 to 2050

4.2 Organization of Recommended Implementation Actions

All of the recommendations have been organized into six major areas of DWSD responsibility in its role as a regional wastewater service provider:

1. Sewer Infrastructure

2. Combined Sewer Overflow and Sanitary Sewer Overflow Controls

3. Wastewater Treatment Plant and Other Facilities

4. Environmental Protection

5. Customer Service

6. Human Resources and Technology

The description of these six areas is outlined in Volume 4 of this Master Plan, *Capital Improvement Program.*

All of the recommendations pertain to actions by DWSD, unless specifically designated for another city department or another wholesale customer or agency.

Table 4.2: DWSD Preliminary 10-Year CIP Program

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
PROGRAM 1 - SEWER INFRASTRUCTURE						
Lateral & Connector Sewers - Cleaning, Sediment Disposal, & Condition Assessment						
CS-1368	Inspection & In-Place Rehab of Existing Circular & Non-Circular Sewers	Ongoing	C	2002	2005	$55,342,000
WWMP-1	Yearly inspection of 2.5% of system or 71 miles of sewer	Proposed	C	2008	2012	$6,130,000
WWMP-2	Of the 2.5% of system inspected, assume 45% needs heavy cleaning (32 miles), 35% needs light cleaning (25 miles), 20% does not need cleaning (14 miles).	Proposed	C	2008	2012	$15,070,000
WWMP-3	Sample each load and dispose according to sample results, with 570 truck loads per year.	Proposed	C	2008	2012	$1,100,000
Lateral and Connector Sewer Improvements						
WS-613	Water System Replacement & Lateral Sewer Replacement	Ongoing	C	2002	2004	$1,871,000
WS-635	Lateral Sewer & Water Main Replacement - Palmer Woods	Ongoing	C	2002	2004	$2,430,000
CS-1240	Department-wide Engineering Services	Ongoing	D	2002	2005	$1,050,000

Notes:

1) Project No.
WWMP numbers are proposed Wastewater Master Plan Projects

No CIP No. = Projects in the 2002/3 - 2006/7 CIP with no project number listed.

2) Status
New = New projects in the 2002/3 to 2006/7 DWSD CIP

Ongoing = Ongoing projects in the 2002/3 to 2006/7 DWSD CIP

Proposed = Proposed Wastewater Master Plan Projects

3) Phase
S = Study
D = Design
C = Construction
DB = Design Build

4) Cost
For WWMP projects, baseline (lower range) 50-yr. CIP estimated cost used.

Current CIP projects less than $100,000 are not included in this list.

* Cost estimate for Wet Weather Source Reduction Demonstration revised based on information from Wade-Trim, LTCSO consultant (6/03).

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
CS-1361	Emergency Sewer Repair Svcs on As-needed Basis	Ongoing	D/C	2002	2006	$11,856,000
No CIP No.	Lateral Sewer Replacement - Oakwood District	New	S/D	2002	2004	$300,000
No CIP No.	Lateral Sewer Replacement Allowance	New	D/C	2003	2007	$32,110,000
No CIP No.	Lateral Sewer Replacement - Oakwood District	New	C	2004	2006	$10,000,000
WWMP-4	Phase 1 rehab/reline/replace of 35% of sewers inspected per year (0.9% of the system), or 25 miles per year	Proposed	C	2006	2008	$36,000,000
WWMP-5	Phase 2 rehab/reline/replace sewers	Proposed	C	2008	2010	$72,100,000
WWMP-6	Phase 3 rehab/reline/replace sewers	Proposed	C	2010	2012	$72,100,000
Interceptor and Trunk Sewer Cleaning, Sediment Disposal, & Sewer Improvements						
WWMP-7	Inspect all interceptors and 1/3 of the trunk sewers by 2010 (35 miles per year) and the remaining 2/3 trunk sewers by 2030 (18 miles per year). 10% of each mile is inspected and assumed to represent the entire mile.	Proposed	C	2008	2012	$446,000
CS-1288	Romeo Arm Interceptor in Garfield Road	Ongoing	D	2002	2004	$177,000
PCI-45	Romeo Arm Interceptor in Garfield Rd from 18-mile to 21-mile	Ongoing	C	2002	2004	$5,631,000
No CIP No.	Outfall Improvements Allowance	New	D	2004	2007	$450,000
No CIP No.	Outfall Improvements Allowance	New	C	2004	2007	$12,000,000
No CIP No.	Repair of Detroit River Outfall No. 1	New	S/D/C	2007+	2007	$1,700,000
WWMP-8	All interceptors and 1/3 of the trunk sewers rehabilitated by 2010 (35 miles per year). 2/3 of the trunk sewers rehabilitated by 2030 (18 miles per year).	Proposed	C	2008	2012	$13,254,000
WWMP-9	All interceptors and 1/3 of the trunk sewers cleaned by 2010 (35 miles per year). 2/3 of the trunk sewers cleaned by 2030 (18 miles per year).	Proposed	C	2008	2012	$1,684,000
WWMP-10	For cleaning before 2010, sediment quantity estimated from current information on quantities in large sewers, extrapolated to the rest of the system. After 2010, assume sediment deposits removed decline by 50% in each cleaning cycle.	Proposed	C	2008	2012	$1,362,000
WWMP-11	Each load of sediment is sampled prior to disposal.	Proposed	C	2008	2012	$522,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
WWMP-12	Modeling of additional relief sewers	Proposed	S	2008	2009	$100,000
WWMP-13	Stop gates at meters CV-3, MB-25 in Macomb County	Proposed	C	2008	2008	$5,525,000
WWMP-14	New N. Gratiot Interceptor	Proposed	C	2004	2012	$20,000,000
WWMP-15	NW Interceptor Improvements. For estimating purposes: Rehabilitate 20% and replace 10% of the interceptor.	Proposed	C	2010	2012	$40,121,000
Manhole and Catch Basin Improvements						
WWMP-16	Inspect 2.5% of manholes per year (1,443) in conjunction with sewer inspections.	Proposed	C	2008	2012	$703,000
WWMP-17	5-15% (72 - 216) of manholes need various minor repairs out of the 2.5% manholes inspected per year.	Proposed	C	2008	2012	$6,028,000
WWMP-18	2% of manholes inspected need replacement (29) out of the 2.5% of manholes inspected per year	Proposed	C	2008	2012	$1,965,000
WWMP-19	Clean and inspect all catch basins every 10 years (20,000 per year)	Proposed	C	2008	2012	$9,184,000
WWMP-20	Of the 10% of catch basins inspected per year, 2.5% require repair (500)	Proposed	C	2008	2012	$2,775,000
Regulators, Outfalls, Backwater Gates, and In-System Storage						
DWS-835	Design/Build Services for Inspection & In-Place Rehabilitation of Helen-Jefferson 63-inch Outfall	Ongoing	D/C	2002	2004	$2,004,000
CM-2004 / PC-709	Detroit River Outfall No. 2	Ongoing	C	2002	2005	$30,000,000
DWS-849	Inspection & In-place Rehabilitation of Outfalls	Ongoing	DB	2002	2004	$9,080,000
DWS-850	Inspection & In-place Rehabilitation of Outfalls	Ongoing	DB	2002	2004	$6,460,000
PC-747	Installation of In-system Storage Device	Ongoing	C	2002	2005	$26,700,000
WWMP-21	Inspect 81 Outfalls, 54 Backwater Gates, & 55 Diversion Dams every 10 yrs.	Proposed	C	2008	2012	$190,000
WWMP-22	Rehab 54 BWGs every 10 yrs.	Proposed	C	2008	2012	$1,080,000
WWMP-23	Inspect all 53 In-System Storage Gates/Devices every year	Proposed	C	2008	2012	$1,242,000
Pump Stations						
PC-674	Conner Creek & Fox Creek Stations Rehab	Ongoing	C	2002	2004	$24,194,000
PC-736	Additional Pump at Northeast Sewage Pumping Station	Ongoing	C	2002	2004	$2,460,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
CS-1279-17&17A	Additional Pump at Northeast Sewage Pumping Station	Ongoing	S/D/C	2002	2005	$675,000
CS-1363	Belle Isle Pump Station (Outfall 083) Improvements and CSO Control	Ongoing	S/D	2002	2005	$2,439,000
No CIP No.	Overhaul of Major Electrical Power Distribution Eqpt	Ongoing	C	2002	2005	$1,108,000
CS-1331	Conner Creek & Fox Creek Stations Rehab	Ongoing	S/D/C	2002	2006	$1,620,000
CS-1346	As-needed Engineering Services	Ongoing	D	2002	2006	$2,512,000
CS-1340	As-needed Engineering Services	Ongoing	D/C	2002	2007	$2,589,000
DWS-837	Switchgear Replacement at Bluehill & Freud Pump Station	Ongoing	D/C	2003	2006	$16,755,000
No CIP No.	Woodmere Pumping Station Rehabilitation	New	S/D	2003	2005	$2,800,000
No CIP No.	Fischer Pumping Station Rehabilitation	New	S/D	2003	2006	$1,200,000
No CIP No.	Clintondale Pumping Station Improvements	New	D	2003	2007	$1,000,000
PC-685 / CS-1340-6	Bluehill Station Rehabilitation	New	D/C	2003	2007 +	$9,900,000
No CIP No.	Fischer Pumping Station Rehabilitation	New	C	2004	2006	$7,200,000
No CIP No.	Clintondale Pumping Station Improvements	New	C	2004	2007	$13,000,000
CS-1363	Belle Isle Main Pumping Station and CSO Control Improvements	New	C	2004	2007 +	$12,500,000
No CIP No.	Woodmere Pumping Station Rehabilitation	New	C	2005	2007	$14,000,000
WWMP-24	All pump stations electrical/mechanical yearly inspection	Proposed	C	2008	2012	$1,516,000
WWMP-25	Yearly pump station rehab cost based on PC-744 Asset Audit	Proposed	C	2008	2012	$12,090,000
WWMP-26	13 pump stations rehabilitated in 50 years, cost spread over 50 years. Replace all components except the concrete.	Proposed	C	2008	2012	$2,121,000
Meters and Billing						
CS-1341	Customer Billing System	Ongoing	D/C	2002	2005	$5,080,000
CS-1282	Flow Verification Svcs Metering Device Calibration	Ongoing	S	2002	2006	$7,000,000
CM-2007	City of Detroit Water Meter Replacement & Auto Reading Eqpt Installation	Ongoing	D/C	2002	2006	$70,000,000
PC-721	Primary Measuring Device Improvements Group 3	Ongoing	C	2002	2007	$10,000,000
CS-1225	Suburban Sewage Primary Measuring Devices Improvements Group 1	Ongoing	D	2002	2007	$1,181,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
No CIP No.	Flow Control and Wastewater Sampling	New	C	2003	2004	$3,000,000
PC-687	Clinton Twp and Fraser Control Facilities	New	C	2007+	2007	$2,000,000
WWMP-27	Ongoing meter maintenance cost per year based on CS-1249	Proposed	C	2008	2012	$13,000,000
WWMP-28	All meters replaced over 50 yrs.	Proposed	C	2008	2012	$7,086,000
WWMP-29	Installation of odor control measures at the m e-ters in Macomb County	Proposed	C	2008	2009	$773,000
Project No.	**Project Name**	**Status**	**Phase**	**Start Date**	**End Date**	**Cost***
	PROGRAM 2 — CSO CONTROL					
CS-1284	Conner Creek Pilot Facility	Ongoing	S/D	2002	2005	$6,656,000
PC-739	Conner Creek CSO Pilot Facility	Ongoing	C	2002	2005	$147,765,000
CS-1329	In-System Storage Device at 30 Designated Lo-cations	Ongoing	S/D	2002	2005	$2,664,000
CS-1374	Sewer System Study of Inflow & Infiltration	Ongoing	S/D	2002	2005	$4,041,000
CS-1286	Baby Creek CSO Pilot Control Facility	Ongoing	S/D	2002	2006	$1,500,000
PC-748	Baby Creek CSO Pilot Control Facility	Ongoing	C	2002	2007	$64,388,000
00-11	Appraisal Svcs, As-needed	Ongoing	D	2002	2007	$500,000
CS-1281	Long Term CSO Control Plan - Ph III	Ongoing	S/D	2002	2007+	$13,304,000
No CIP No.	Rouge River CSO Control Plan - Ph 3	New	S/D	2003	2004	$2,500,000
CS-1364	CSO Control for Oakwood Pumping Station	New	S/D	2003	2007+	$16,500,000
No CIP No.	Upper Rouge River CSO Control Alternatives	New	S/D	2003	2007+	$99,000,000
No CIP No.	Other Land Acquisition	New	C	2004	2007+	$42,000,000
No CIP No.	Upper Rouge River CSO Control Alternatives	New	C	2005	2007+	$620,000,000
No CIP No.	Wet Weather Source Reduction Demonstration - LTCSO Plan*	New*	D	2004	2007+	$12,000,000
No CIP No.	Wet Weather Source Reduction Demonstration - LTCSO Plan*	New*	C	2007+	2007+	$62,000,000
CS-1364	CSO Control for Oakwood Pumping Station	New	C	2006	2007+	$88,000,000
WWMP-30	Cost for one CSO basin on Lower Rouge	Proposed	S/D/C	2010	2012	$15,000,000
WWMP-31	Rehab of CSO facilities estimated at $6M/year	Proposed	C	2008	2012	$30,000,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
PROGRAM 3 - WASTEWATER TREATMENT PLANT AND OTHER FACILITIES						
Liquid Train Facilities						
CS-1150	Detroit River Outfall Disinfection Facilities	Ongoing	D	2002	2004	$1,670,000
PC-693 / CS-1150	Detroit River Outfall Disinfection Facilities	Ongoing	C	2002	2004	$1,456,000
PC-704	Oakwood Sampling Station and MPI Sampling Station	Ongoing	D	2002	2004	$180,000
PC-704	Oakwood Sampling Station and MPI Sampling Station	Ongoing	C	2002	2004	$1,064,000
CS-1311	Primary Clarifiers 17 and 18 at WWTP	Ongoing	S/D/C	2002	2005	$5,808,000
PC-740	Primary Clarifiers 17 and 18 at WWTP	Ongoing	C	2002	2005	$59,000,000
PC-735	New Chlorination Facility at Detroit Marine Terminal	Ongoing	C	2002	2005	$4,187,000
CS-1289	Determination of Intermediate Lift Pump Spec and Cost Soln	Ongoing	S/D	2002	2005	$624,000
PC-720	Secondary Clarifier Improvements	Ongoing	C	2002	2006	$35,400,000
PC-744	Program Mgmt for WWTP Rehab & Upgrade	Ongoing	S/D	2002	2006	$79,000,000
PC-7441007	Replacement of Main Lift Pumps at Pump Station 1	Ongoing	S/D	2002	2006	$2,800,000
No CIP No.	Replacement of Pickle Liquor Pumps at New Pump Station 2A	New	C	2002	2004	$126,000
PC-7441046	Replace Primary Electrical Feed for Rectangular Tanks	New	S/D	2002	2004	$200,000
PC-7441054	Renovation of 2 Oxygen Cryogenic Plants	New	S	2002	2004	$680,000
PC-7441018	Boiler System Improvements	New	S/D/C	2002	2004	$2,963,000
No CIP No.	Variable Speed Pump Motor Controls at Wastewater Pumping Station	New		2002	2005	$4,500,000
PC-7441033	Secondary Water Pumping System	New	C	2002	2005	$2,429,000
PC-7441005	Aeration Basin System Improvements - Basins 1-4	New	D	2002	2005	$860,000
PC-7441005	Aeration Basin System Improvements -Basins 1-4	New	C	2002	2006	$50,000,000
PC-7441007	Replacement of Main Lift Pumps at Pump Station No. 1	New	C	2002	2006	$25,000,000
PC-7442004/ CS-1289	Replacement of Intermediate Lift Pumps 1 & 2	New	C	2003	2005	$7,000,000
PC-7441015	Replace Troughs & Weirs in Rectangular Primary Sedimentation Tanks 1 -12	New	D/C	2003	2006	$2,650,000
PC-7441054	Renovation of 2 Oxygen Cryogenic Plants	New	DB	2003	2006	$6,120,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
PC-7441046	Replace Primary Electrical Feed for Rectangular Tanks	New	C	2004	2006	$2,000,000
PC-7441048	New Sampling Facilities for Primary Effluent	New	D/C	2007+	2007+	$200,000
PC-744	Improvements to Rectangular Primary Clarifier Pipe Gallery	New	S/D	2007+	2007+	$928,000
PC-744	Improvements to Rectangular Primary Clarifier Pipe Gallery	New	C	2007+	2007+	$7,200,000
PC-7441052	General Utility - Job Orders Contracting	New	S/D/C	2007+	2007+	$2,500,000
PC-7441027	Potable Water Backflow Prevention Improvements	New	S/D/C	2007+	2007+	$1,678,000
No CIP No.	WWTP Pilot Plant Upgrade	New	C	2007+	2007+	$1,090,000
Biosolids Train Facilities						
PC-722	Thickener Tank Improvements for Sludge Processing Complex A	Ongoing	S/D/C	2002	2004	$1,940,000
PC-723	Dry Ash Handling System - Complexes 1 & 2	Ongoing	DB	2002	2004	$312,000
PC-7441003	Incinerator Burner Train Improvement	Ongoing	DB	2002	2004	$16,000,000
CS-1290	Replace 16 BFPs in Complex 2	Ongoing	S/D/C	2002	2005	$1,808,000
PC-7441049	Replacement of Bird Centrifuge Equipment	Ongoing	S/D	2002	2007+	$213,000
PC-7441074	Central Off-Load Facility	New	D	2002	2004	$2,000,000
No CIP No.	Renovate Gas Lines to Incinerators - Gas Trains in Complex 1	New	S/D/C	2002	2004	$1,151,000
PC-750/ PC-7442001	Replacement of 16 BFPs on Lower level of Complex 2	New	C	2002	2004	$16,368,000
PC-741/ PC-7441038	Rehab of Scum Incinerator Bldg	New	S/D	2002	2004	$550,000
PC-7441016	Rehab Thickener Comples A & B	New	C	2002	2005	$22,500,000
PO	Renovation of Multiple Hearth Incinerators	New	C	2002	2005	$8,973,000
PC-7441044	Rebuilding BFPs - Complex 1	New	S/D	2003	2004	$1,300,000
PC-7441074	Central Off-Load Facility	New	C	2003	2005	$19,088,000
PC-7441028	Improve Complex 2 Incineration Bldg Drainage System	New	C	2003	2006	$2,580,000
PC-741/ PC-7441038	Rehab of Scum Incinerator Bldg	New	C	2003	2006	$4,550,000
PC-7441044	Rebuilding BFPs - Complex 1	New	C	2004	2005	$5,700,000
PC-7441050	Rehab Sludge Pump Stations 1 & 2	New	S/D/C	2007+	2007+	$6,100,000
PC-7441049	Replacement of Bird Centrifuge Equipment	New	C	2007+	2007+	$11,969,000
PC-7441044	Rebuilding BFPs - Complex 2	New	D	2007+	2007+	$2,000,000
PC-7441044	Rebuilding BFPs - Complex 2	New	C	2007+	2007+	$20,000,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
No CIP No.	CBIS/SCADA Facility Dept. Computer System	Ongoing	C	2002	2004	$787,000
No CIP No.	As-needed Engineering Services at Systems Operations Control	Ongoing	D	2002	2005	$1,500,000
LS-1388	800 MHz Trunked Radio System	Ongoing	S/D	2002	2005	$506,000
PO-2564018	Radio SCADA Overhaul	Ongoing	C	2002	2006	$179,000
No CIP No.	Interim Overhaul of Systems Control Center Process Control Eqpt	Ongoing	C	2002	2006	$450,000
PC-713/ CS-1294/ CS-1255	Instrumentation,Control & Computer System Program at WWTP	Ongoing	D/C	2002	2007+	$157,107,000
No CIP No.	WWTP Instrumentation & Control	New	D/C	2002	2006	$9,548,000
No CIP No.	821 MHz Radio Trunking System Svcs on an As-needed	New	C	2003	2007+	$18,000,000
PC-7441032	Detroit Marine Terminals & Improvement	New	S	2007+	2007+	$710,000
PC-7441032	Detroit Marine Terminals & Improvement	New	D/C	2007+	2007+	$7,000,000
WWMP-32	$150 M per year to cover ongoing WWTP rehabilitation and replacement and system control improvements after 2007	Proposed	C	2008	2012	$750,000,000
Buildings and Grounds						
DWS-829 / CS-1291	Department-wide Pavement Replacement & Repair Project	Ongoing	D/C	2002	2004	$4,084,000
CS-1292	Dept-wide Engineering Svcs, As-needed	Ongoing	D	2002	2004	$1,638,000
DWS-824	WWTP Warehouse	Ongoing	DB	2002	2005	$15,409,000
CM-2005	Job Order Contract - Request for Qualifications	Ongoing	C	2002	2005	$1,816,000
DWS-838	Department-wide Roof Replacement & Repair	Ongoing	D/C	2002	2005	$3,211,000
CS-1372	Geotechnical Engineering Services on As-needed Basis	Ongoing	S/D	2002	2005	$2,692,000
PC-745	WWTP Skilled Trades Assistant Contract IX	Ongoing	C	2002	2005	$33,998,000
DWS-833	As-needed Low Voltage Wiring	Ongoing	C	2002	2005	$3,977,000
CS-1387	As-needed Engineering Services for Construction	Ongoing	C	2002	2005	$2,850,000
PO 2506584	Dept-wide Furniture Purchase / Acquisition	Ongoing	C	2002	2005	$1,425,000
No CIP No.	CA Unicenter	Ongoing	C	2002	2005	$1,712,000
CS-1347	As-needed Svcs for Geotech	Ongoing	D/C	2002	2006	$2,943,000
CM-2006	Job Order Contracting As-needed General Construction Services	Ongoing	C	2002	2006	$1,296,000
CS-1345	As-needed Engineering Services	Ongoing	D	2002	2007	$2,550,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
DWS-804	Replace Fire Alarm System - WBB	Ongoing	S/D/C	2002	2007+	$402,000
PC-7441025	Upgrade Electrical Supply	New	S/D	2002	2004	$300,000
PC-7441023	Renovate/Combine Operation's Lab Facility at WWTP	New	D	2002	2004	$340,000
PC-7441023	Renovation of Old Admin & Ragland Bldg	New	S/D	2002	2004	$1,100,000
No CIP No.	Removal of Underground Heating Oil Storage Tanks at Various DWSD Locations	New	S/D/C	2002	2004	$500,000
PC-7441021	Rehabilitate Parking Structure - WWTP	New	C	2002	2005	$1,900,000
No CIP No.	Transformer Reclassification Various Locations	New	C	2002	2005	$126,000
No CIP No.	Job order Contracting - As-needed General Construction Svcs	New	C	2002	2006	$4,500,000
CS-1349	Roof and Pavement Asset Mgmt Program and As-needed Eng Svcs	New	D	2002	2006	$2,500,000
No CIP No.	PCB Contaminated Transformers Replacement	New	C	2003	2004	$100,000
No CIP No.	Uninterruptable Power Supply and Electrical Backup Systems	New	S/D/C	2003	2004	$1,500,000
No CIP No.	Relocation of WWTP Analytical Lab	New	S/D/C	2003	2006	$10,000,000
PC-7441025	Upgrade Electrical Supply	New	C	2003	2006	$2,677,000
PC-7441023	Renovate/Combine Operation's Lab Facility at WWTP	New	C	2003	2006	$3,100,000
PC-7441023	Renovation of Old Admin & Ragland Bldg	New	C	2003	2006	$10,000,000
PC-7441037	Troubleshoot/Replace Plant-wide UPS System	New	C	2003	2006	$1,000,000
PC-7441036	Repair & Improve HVAC Controls & Monitoring System	New	C	2004	2007	$5,000,000
No CIP No.	Main Office Bldg - Office Relocation	New	D/C	2004	2007	$21,250,000
PC-7441043	Renovation of Maintenance Bldg	New	S/D/C	2007+	2007+	$3,335,000
PC-7441039	Renovation of Operations Bldg	New	S/D/C	2007+	2007+	$3,000,000
PC-7441040	Rehab of Misc Bldgs	New	S/D/C	2007+	2007+	$1,500,000
PC-7441041	Rehab of Electrical Buildings	New	S/D/C	2007+	2007+	$2,600,000
PC-7441026	Fire Protection Improvements	New	S/D/C	2007+	2007+	$2,796,000
PC-7441001	Expansion of New Administration Bldg - WWTP	New	S/D/C	2007+	2007+	$10,100,000
PC-7441045	Third Primary Power Feed	New	S/D/C	2007+	2007+	$4,400,000
No CIP No.	Underground Electrical Duct Bank Repair - WWTP	New	S/D/C	2007+	2007+	$4,400,000
PC-7441014	Intercom System	New	S/D/C	2007+	2007+	$1,000,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
PROGRAM 4 - ENVIRONMENTAL PROTECTION						
CS-1314	Wastewater Master Plan	Ongoing	S	2002	2004	$3,384,000
CS-1295	Pre-Treatment Program Database Management	Ongoing	S/D	2002	2004	$1,897,000
CS-1390	Assistance with Regulatory Agencies	New	S	2002	2006	$481,000
WWMP-33	Install new gravity sewer to sewer remaining septic tanks in the City	Proposed	C	2008	2012	$260,000
PROGRAM 5 - CUSTOMER SERVICE						
CS-1336	Assistance with Public Involvement for CSO Planning	Ongoing	D	2002	2004	$1,497,000
PC-7441064	Local Economic Development (LED) Public Involvement	Ongoing	C	2002	2006	$2,039,000
New CIP Proj.	Customer / Community Planning Study	New	S	2007+	2007+	$200,000
PROGRAM 6 - HUMAN RESOURCES AND TECHNOLOGY						
GIS and Computer Systems						
No CIP No.	System Data Capture, Analysis & Reporting at Systems Control Center	Ongoing	C	2002	2004	$550,000
No CIP No.	Sewage System Operations Manuals & Expert system	Ongoing	D	2002	2004	$1,000,000
No CIP No.	Departmental Storage Mgmt Backup Systems	Ongoing	D/C	2002	2004	$471,000
CS-1367	Expanded GIS Svcs and Implementation	Ongoing	D	2002	2006	$6,399,000
CS-1343	As-needed Aerial Photography Svcs	Ongoing	C	2002	2007	$2,940,000
No CIP No.	Document Control Improvement Program (DCIP)	Ongoing	S/D	2002	2007	$1,775,000
No CIP No.	Information Systems Technical Support	New	S/D/C	2002	2005	$2,250,000
CS-1333	Facilities As-Built Documentation Dev and Maint Svcs	New	D/C	2002	2007+	$3,250,000
No CIP No.	Information Systems Wide Area Network Improvements	New	S/D	2003	2004	$500,000
No CIP No.	Computer Hardware/Software	New	C	2003	2005	$3,600,000
No CIP No.	Network Infrastructure Planning and Construction	New	C	2003	2006	$5,865,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
No CIP No.	Technical Eqpt Improvement Program (Evergreening)	New	S/D/C	2003	2007	$3,000,000
No CIP No.	Information Systems Wide Area Network Improvements	New	C	2004	2007	$22,000,000
No CIP No.	As-needed Engineering Support and Administrative Assistance	New	D	2004	2007+	$7,000,000
No CIP No.	Technical Data Control Program	New	D/C	2004	2007+	$3,250,000
No CIP No.	Information Systems Data System Improvement	New	S/D	2005	2006	$125,000
No CIP No.	Information Systems Local Area Networok Improvements	New	S/D	2005	2006	$125,000
No CIP No.	Information Systems Data System Improvement	New	C	2005	2007	$1,835,000
No CIP No.	Information Systems Local Area Networok Improvements	New	C	2005	2007+	$3,375,000
No CIP No.	Application Development and Server Improvement	New	S/D	2006	2007	$125,000
No CIP No.	Application Development and Server Improvement	New	C	2006	2007+	$2,375,000
Asset and Financial Management						
CS-1234	Eng & Prof Svcs for Bond Sale	Ongoing	D	2002	2004	$150,000
CS-1267	WW Operations Grp Mgmt Information System - Tech Assistance	Ongoing	D	2002	2004	$11,141,000
CS-1304	As-needed CIP Implementation Assistance and As-needed Related Services	Ongoing	D	2002	2005	$3,149,000
CS-1375	EMPAC System Svcs & Implementation Support	Ongoing	D	2002	2005	$4,475,000
No CIP No.	Professional Survey Services and Property Database Implementation	New	D/C	2002	2004	$1,000,000
No CIP No.	Expert System Modeling System	New	D/C	2004	2006	$1,250,000
No CIP No.	Facilities Mgmt Information System - WWTP	New	S	2005	2006	$500,000
No CIP No.	Facilities Mgmt Information System - WWTP	New	C	2005	2007+	$9,375,000
Energy Management						
CS-1272	Study & Evaluation of DWSD Electric Utility Rates	Ongoing	S	2002	2006	$811,000
WWMP-34	Evaluate and install energy-conserving improvements by 2010 (VFDs in pump stations)	Proposed	C	2008	2009	$295,000

Table 4.2: DWSD Preliminary 10-Year CIP Program (continued)

Project No.	Project Name	Status	Phase	Start Date	End Date	Cost*
Emergency Preparedness						
PC-7441047	Improve Plant Security	New	S/D	2002	2005	$360,000
PC-7441047	Improve Plant Security	New	C	2005	2006	$3,240,000
Staff Development and Recruiting						
PC-7441068	Training Services for Wastewater Treatment Plant	Ongoing	C	2002	2006	$1,000,000
Total						$3,694,002,000

4.3 Sewer Infrastructure

The sewer infrastructure area is comprised of eight programs:

- Lateral and Connector Sewer Condition Assessment
- Interceptor and Trunk Sewer Condition Assessment
- Lateral and Connector Sewer Improvements
- Interceptor and Trunk Sewer Improvements
- Manholes and Catch Basins
- Outfalls, Regulators, Backwater Gates and In-System Storage
- Pump Stations
- Meters

Recommendations for each program are presented below. The recommendations describe general goals for each program and measurable objectives for each of the three planning intervals.

Figure 4.1 on the following page shows planned and proposed infrastructure improvements. Table 4.3 lists the major necessary infrastructure projects by DWSD first-tier customers related to the recommendations of this Master Plan.

4.3.1. Lateral and Connector Sewer Condition Assessment

This program includes cleaning, sediment disposal, and condition assessment of Detroit sewers that are generally 30-inches in diameter and smaller. The goals of the lateral and connector sewer cleaning, sediment disposal and condition assessment program are:

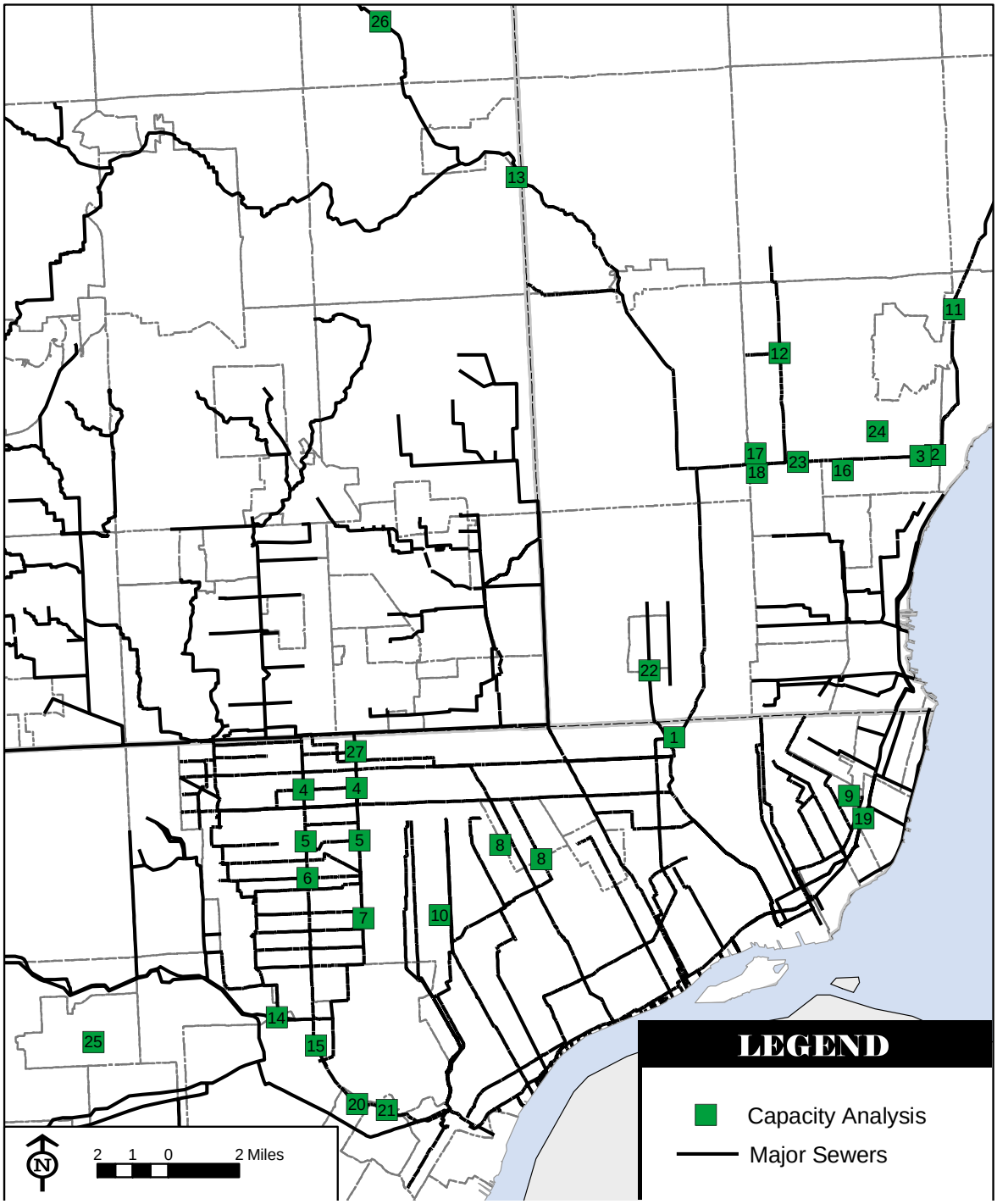
- Perform sewer cleaning and sediment disposal (as needed for sewer inspection and maintenance of the capacity of sewers) cost-effectively and in compliance with environmental regulations.
- Reduce Detroit retail customer sewer complaints.
- Improve DWSD's documentation of repairs and responses to complaints to proactively address potential lawsuits for basement flooding.
- Meet upcoming requirements for CMOM (capacity, maintenance, operations, and management).
- Develop and organize data on Detroit's lateral and connector sewers using asset management tools and prepare annual reports on progress.

Table 4.3: Potential Projects by First-Tier Customers

Map # *	District Served	Potential Project
20	Allen Park	Pump station, with possible EQ basin, to be built to lift flows into NWI during wet weather events
21	Melvindale	Improve capacity at pump station, along with possible EQ basins to attenuate peak discharges
22	Center Line	Increase contract capacity. May include increase in capacity of connecting sewer and/or changing point of connection to NIEA or Corridor Interceptor
23	Fraser	SSO case study -- potential controls being investigated
24	Clinton Twp	SSO case study -- potential controls being investigated
25	Garden City	SSO case study -- potential controls being investigated
26	Clinton-Oakland	Based on report, Paint Creek Interceptor currently surcharging, additional capacity needed
27	Evergreen Farmington	Potential for additional outlet capacity investigated

*See Figure 4.1 on Page 4-13

Figure 4.1: Planned and Proposed Wastewater Infrastructure Improvements



Numbers 1-3 show recommended pump station upgrades. See Table 4.9 on Page 4-31.
Numbers 4-10 show recommended relief sewers. See Table 4.5 on Page 4-19.
Numbers 11-18 show recommended meter upgrades and recommended new meters. See Table 4.10 on Page 4-32.
Numbers 20-27 show potential projects by first-tier customers. See Table 4.3 on Page 4-12.

Early Period

DWSD currently cleans and inspects less than 1 percent of its collection system in Detroit (20 to 30 miles) each year in response to customer complaints and sewer service calls. DWSD should expand its cleaning and inspection program in the city over a period of five-10 years so that it inspects an average of 70 miles of sewer per year on a proactive basis. At a rate of 70 miles per year there will be inspection and cleaning of sewers every 40 years. Any reaches of sewer that are cleaned and inspected in response to complaints would apply toward the 70-mile annual objective.

Based on data collected for this Master Plan, a proactive program would be designed as follows:

- Each year, prepare a map of the planned inspection program. The map would be shared with other departments and agencies with the City of Detroit, Wayne County, and MDOT, as well as electric, gas, telephone and cable TV companies. Inspection work by DWSD would be coordinated with street and utility improvement projects.

- Priority areas where there have been customer service problems would be targeted for inspection. For example, in early years, approximately 50 percent of the miles of inspection and cleaning should be devoted to the Oakwood District and the Baby Creek District.

- Distribute the remaining 50 percent of the miles of cleaning between the other seven districts according to complaint history and dry weather infiltration/inflow reduction goals.

- Prepare annual reports detailing the condition of sewer lengths inspected, cleaning and rehabilitation performed, all in accordance with data requirements of the DWSD's existing asset management databases.

Periodically evaluate costs for inspection and cleaning sewers as performed by DWSD staff compared to work performed through projects under contract to the DWSD. At present, DWSD crews perform some inspection and cleaning work and contract crews do some. The purpose of the evaluation is to determine the most cost-effective combination of DWSD crews and contract crews, as well as the most cost-effective division of responsibilities.

Evaluate the progress on contract CS-1325, Inspection and Rehabilitation of Existing Circular Sewers and contract CS-1368, Inspection and Rehabilitation of Existing Circular and Non-circular Sewers at the completion of these contracts. The evaluation should include the following tasks:

- Review volumes of sludge removed, handling and disposal practices, and identify "best practices" and potential improvements for long-term rehabilitation program needs identified in this Master Plan.

- Analyze the technology being used and the information recorded, and give recommendations for improvement/refinement.

- Identify benchmarks for cleaning, inspection, and condition assessment focusing on structural condition, release of bedding material into the sewer, and capacity restrictions.

- Evaluate adding a manhole inspection program, also focusing on structural condition, while laterals and connectors are inspected.

- Develop specifications for future sewer inspection and rehabilitation work.

Convert all of its existing information on lateral and sewer condition assessment (along with existing information in the Department's asset management databases) into a GIS-based asset management system. By 2005, DWSD will have a GIS architecture established by its current GIS project (CS-1367), and it has all necessary database and GIS display tools for asset management as deliverables under this Master Plan project, CS-1314. Asset management tools should be developed and implemented under the Asset Management Pro-

gram, which is described later in this report.

Perform a root intrusion study to determine scope of problem and investigate long-term solutions with a pilot program starting the following year.

Review and upgrade its facilities and procedures for handling and disposing of sewer sediments. (See discussion of technologies and current practice in Volume 4, *Capital Improvement Program.*)

Investigate sewer reaches that are prone to rapid buildup of sediments. Investigations performed for this Master Plan have shown that newly relined sewers have filled with sediment in less than five years. The investigation should look for upstream sources of sediment that can be controlled, and it should look at the feasibility of a routine sewer-flushing program.

Annually identify any sewers that should be sealed and abandoned based on inspection results, changes in land use, or changes in the public right-of-way or easement.

Middle and Late Periods

At the end of each decade, review the progress achieved on lateral and connector sewer inspection and cleaning. Determine if the goal of 70 miles per year should be increased or decreased based on costs and results achieved.

4.3.2 Interceptors and Trunk Sewer Condition Assessment

This program includes inspection, condition assessment, and cleaning where necessary, of trunk sewers and interceptors. Based on limited inspections that DWSD has performed to date, most of the trunk sewers and interceptors are believed to be in good condition. There are four goals of the trunk sewer and interceptor inspection and condition assessment program:

- Perform a comprehensive inspection of interceptors and trunk sewers.
- Meet upcoming requirements for CMOM (capacity, maintenance, operations, and management).
- Eliminate sources of excessive dry weather infiltration and inflow.
- Develop and organize data on trunk sewers and interceptors for an asset management program and prepare annual reports.

Early Period

In the period from 2004 to 2015, the objective of this program is to complete the inspection, condition assessment, and associated data management and reporting on approximately one third of all trunk sewers (about 290 miles) and all interceptors (79 miles). Specific recommendations are listed below.

From 2004 to 2015, perform a physical inspection of interceptors and approximately one third of its trunk sewers. The inspection should be designed to analyze representative accessible reaches of interceptors and trunk sewers based on construction contracts, materials, size, depth, and soil condition. In general, about one-tenth of the system should be inspected, or about 1,000 feet for every two miles of sewer, over the entire 11-year period.

Create annual reports detailing the condition of all sewer lengths inspected, all cleaning and rehabilitation performed, all in accordance with the data requirements of the DWSD's existing asset management databases.

Periodically evaluate the results of its trunk sewer and interceptor inspection program and make appropriate revisions to the inspection techniques and rehabilitation methods based on experience that has been gained. Particular attention should be paid to inspection of sewer crowns that have been rehabilitated in response to hydrogen sulfide corrosion in interceptors serving Macomb County.

Middle Period

In the period 2016 to 2030, perform inspections, condition assessment, and associated data man-

agement and reporting on the remaining two-thirds of all trunk sewers (about 570 miles).

Late Period

In the period 2031 to 2050, perform continuing inspections at a frequency and sampling as determined necessary through the results of the previous inspections.

4.3.3 Lateral and Connector Sewer Improvements

This program includes the rehabilitation or replacement of lateral and connector sewers to meet performance standards. The goals of the lateral and connector sewer improvement program are:

Rehabilitate sewers to extend the useful life by at least 50 years.

Identify private service connections that are improperly constructed and correct them.

Eliminate sources of excessive infiltration or inflow where cost-effective. Make improvements based on recommendations of the DWSD I/I project (CS-1374).

Meet upcoming requirements for CMOM (capacity, maintenance, operations, and management).

Improve documentation of repairs and responses to complaints to proactively address potential lawsuits for basement flooding.

Provide accurate data on the rehabilitation work for the Asset Management Program.

Early Period

Rehabilitate sewers that have been verified to be below its service standards. Based on information collected for this Master Plan, it is estimated that approximately 120 to 180 miles of lateral and connector sewer will need to be rehabilitated in this period.

Continue to use the sewer rehabilitation technique of cured-in-place lining, either for entire sewer reaches or spot repairs as needed. Continue to investigate or pilot test other rehabilitation techniques for particular situations, such as pipe bursting or slip-lining.

Repair, rehabilitation, and replacement of the sewers in Detroit can be undertaken most cost-effectively by:

Coordinating all sewer replacement work with the city's Department of Transportation, Roads Division. Road work and work on water and sewer lines should be combined into one operation to reduce disruption to city residents and the cost of repairing roads once sewer work is completed. A coordinating committee between the DOT and DWSD should be established as a top priority.

Focusing sewer rehabilitation and replacement work on one area or neighborhood at a time, to reduce staff travel time. Establishing a goal to rehabilitate one area at a time and completing that work will lead to more measurable and positive results. DWSD can work with neighborhood precinct and city hall groups to advertise and schedule work in each area.

Periodically assessing progress on recording information in the asset management database. Strive for all rehabilitation work to be fully recorded in the asset management database within 60-days of completion of rehabilitation of each sewer reach.

Reviewing and revising sewer construction standards in *Division III: Guidelines for Sewer System Design and Detailing in the City of Detroit,* and *Division IV: Guidelines for Sewer System Construction in the City of Detroit, General and Detailed Specifications*. The new standards should incorporate the latest technology and design standards for sewer construction.

Constructing new local sewers and pumping stations to serve properties in the city that are now believed to have septic systems. (See program for *Facilities on Private Property* for more information).

Revise the following specifications administered

by the Urban Design Section, Engineering Services Division to conform to new practices in sewer construction:

Division I: Rules and Regulations Applying to Sewer Permit Work

Division III: Guidelines for Sewer System Design and Detailing in the City of Detroit

Division IV: Guidelines for Sewer System Construction in the City of Detroit

The current specifications were first written in the 1970s, and have been amended periodically. The current specifications should be completely updated at least every ten years. New specifications should utilize the latest standards issued by professional organizations such as American Society of Testing and Materials (ASTM), American Water Works Association (AWWA) and Water Environment Federation (WEF). Differences between the DWSD standards and the plumbing standards of the Building and Safety Engineering Department should also be resolved.

The Engineering Services Division should form a Standards Technical Review Committee to review current standards and recommend changes. This committee could also review and certify acceptable construction materials and practices in the DWSD system for the following types of construction: 1) issuance of permits for sewer hookups and privately-constructed subdivision sewers; 2) construction of sewers under DWSD-funded contracts; 3) construction of service connections, and 4) other activities that may impact the sewer system, such as downspout disconnection. The Committee should work with other City Departments, such as the Building and Safety Engineering Department, to develop a city-wide standard.

Detroit specifications should be compared to specifications used in other communities in Michigan and the appropriate revisions made to incorporate the latest technology and construction practices. Examples of specific recommended changes are shown in Table 4-4.

Middle Period

In the period 2016 to 2030, continue to rehabilitate sewers that have been verified to be below its service standards. Based on information collected for this Master Plan, it is estimated that a minimum of 370 miles of lateral and connector sewer will need to be rehabilitated in this period.

Late Period

In the period 2031 to 2050, continue to rehabilitate sewers that have been verified to be below its service standards. Based on information collected for this Master Plan, it is estimated that a minimum of 490 miles of lateral and connector sewer will need to be rehabilitated in this period.

4.3.4 Interceptor & Trunk Sewer Improvements

This program addresses the need for additional relief sewers and the rehabilitation/replacement of structural defects in the interceptors and trunk sewers. The goals of the interceptor and trunk sewer improvements program are:

- Repair structural defects and excessive sediment deposition identified in the condition assessment task of this Master Plan and in ongoing inspection efforts.
- Assess the need to provide additional relief sewers and possible alternatives that may be more cost-effective in areas with potential basement flooding problems.
- Meet upcoming requirements for CMOM (capacity, maintenance, operations, and management).
- Develop and organize data on all interceptors and trunk sewers for an asset management program, and prepare annual reports.
- Develop a procedure for evaluating requests for additional capacity from DWSD customers, in-

Table 4.4: Recommended Items to Consider for Update of Design and Construction Standards

Sewer Construction:

1. Materials: Only clay, concrete, reinforced concrete or cast iron pipe are approved for sewer installations. Clay pipe is seldom a preferred material for sewer construction, and concrete pipe is usually used only for larger sewers. PVC, HDPE, and similar materials are commonly used in other communities for smaller sewers. Use of these materials should be reviewed by the DWSD Standards Technical Committee, and appropriate standards and construction guidelines added to the current standards. Concrete and reinforced concrete pipe should be constructed with Type II cement to reduce corrosion due to hydrogen sulfide.
2. Jacked or tunneled excavation: Minimum standards of pipe quality and construction should be specified for pipe that is installed by jacking or tunneling.
3. Leak testing requirements are mentioned in the specifications but are not mandatory. The protocol for leak testing using air pressure or vacuum testing should be described in the specifications, and required as part of the certification process for newly installed pipes.

Pipe Lining: Pipe lining systems should be reviewed and certified by a DWSD Technical Review Committee for use in the DWSD. If lining systems do not provide structural support to deteriorated pipe, construction for such support should be required.

Pipe Joints: Pipe joint requirements should reference ASTM or AWWA standards.

Backflow Prevention should be included in all homes where the lowest floor elevation (basement floor) is below the elevation of the upstream manhole rim elevation.

Directional Drilling: Specifications should be written covering acceptable use of directional drilling.

Manholes:

1. Brick construction manholes are no longer commonly used and should be deleted from new construction specifications.
2. Manholes should be leak-tested using water or air pressure testing techniques.
3. Connection between manholes and sewers are a common source of leakage. Flexible connectors should be considered for specification to reduce leakage at this connection.
4. Manhole covers should be constructed to reduce infiltration while allowing for venting. Locked manhole covers should be considered for new construction to reduce disposal of items in the manholes.

Service Connection Construction: Service connection construction standards are generally covered under the plumbing code, and enforced by the Building and Safety Engineering Department. The standards for materials of construction and method of connection to the DWSD sewer system should be reviewed by DWSD to reduce infiltration into the system.

Downspout Disconnection Program: Standards for disconnection of downspouts from combined sewers should be developed as part of the overall construction standards. An important requirement for this program is the routing of stormwater on the property after disconnection of downspouts.

Use of Appropriate National Standards for Materials: All pipe materials, joints, lining material, connectors, and manhole components should be required to conform to the latest ASTM (American Society of Testing and Materials) or AWWA (American Water Works Association) standard. Acceptable materials of construction meeting specific ASTM and AWWA standards should be cited by number for each material and system component. Methods of construction should also conform to professional standards.

Process for Approval for Exceptions to Standards: A DWSD Technical Committee should be formed to develop a process for review of exceptions to the standards.

1. New standards for separate storm sewers and separate sanitary sewers where built within the city.
2. Standards for new sewer connections from suburban customer communities.
3. References to new standards to be inserted into new customer contracts.

cluding increased interceptor and pump station capacity.

Early Period

Complete necessary structural repairs and remove excessive sediment deposits that have been identified in the interceptors and trunk sewers studied during this Master Plan. Table 4.3 provides a list of the required work.

Perform a comprehensive update of information that has been collected by the DWSD regarding basement flooding complaints. DWSD has previously identified areas needing relief sewers to convey the 10-year design storm (1.9 inches of rain per hour). Hydraulic modeling performed for this Master Plan confirmed that at least seven relief sewers are needed to convey the 10-year storm. See Figure 4.2. Additional areas may be identified that may have inadequate relief sewers, through field investigations and modeling. Relief sewers that may be required are listed in Table 4.5.

The following approach is recommended based on the requirements of Public Act 222 of 2001.

- Update System Inventory of Problem Areas – Use new GIS tools developed under this Master Plan to document problem areas and information on the trunk, connector and lateral sewers in the vicinity of each problem area.

- Complaint Record Review – Basement flooding complaint records were reviewed for this Master Plan. DWSD is improving its Work Order Tracking System (WOTS) and link it to the GIS system, to enhance its ability to assess where problems are located for capacity reviews and corrective actions.

- Scheduled Cleaning and Inspection – DWSD has been inspecting and cleaning its lateral sewers in the vicinity of basement flooding complaints. All pipe segments that have been cleaned should be mapped in the GIS system. The map should be reviewed with respect to the location of recent complaints. Complete the cleaning and assessment program for sewers that carry flow from the complaint areas to the nearest trunk sewers.

- Assessment -- DWSD has suspected that basement flooding in some areas may be the result of clogged service connections. It is possible that there is sediment and other material in the smaller lateral sewers. On these smaller pipe sizes, it is critical that sediment and other materials be

Table 4.5: Areas That May Need Relief Sewers

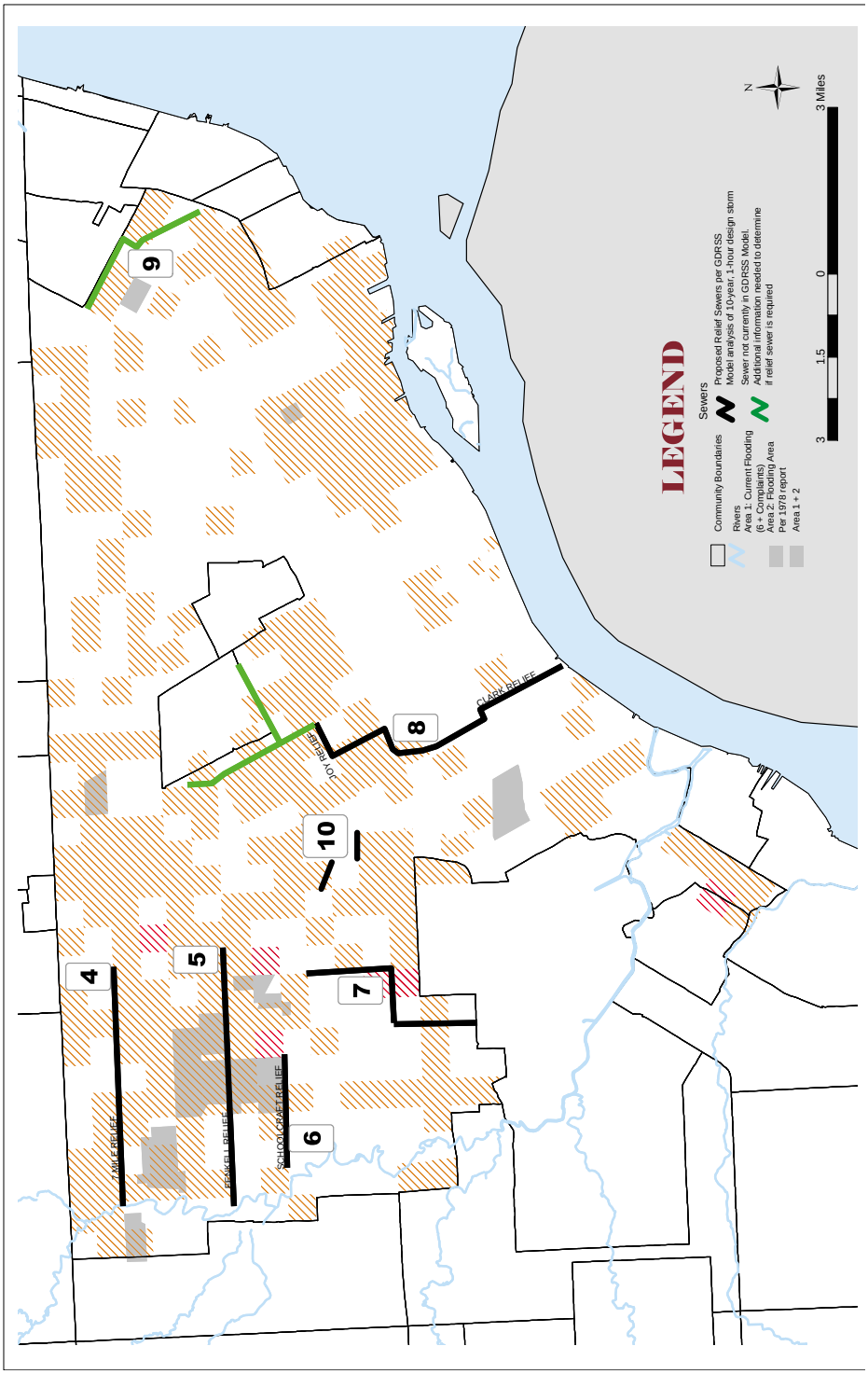
Map # *	District Served	Location of potential flooding	Comment/Recommendation
4	Hubbell / Southfield	Curtis to 8 Mile	New 7 Mile Relief sewer, 10-ft in diameter, from Hubbell to Rouge River
5	Hubbell / Southfield	Lyndon to Puritan	New Fenkell Relief sewer, 13 to 16 feet in diameter, from Hubbell to Rouge River
6	Southfield	Schoolcraft to Lyndon	New Schoolcraft Relief sewer, 16-ft in diameter, from Southfield to Rouge River
7	Hubbell	Paul to Plymouth	New Hubbell Relief sewer, 12-ft in diameter, from Plymouth to Paul
8	Baby Creek	North of Joy, West of Highland Park	New Joy/Clark Relief, 16-ft in diameter, Puritan to Detroit River
9	Fox Creek	Northeast of Cadieux	New Rivard Relief sewer, not sized, Kelly to Canfield
10	Baby Creek	W Chicago & Grand River	New relief on Grand River and West Chicago not confirmed or sized

Based on the 10-year, 1-hour storm event. Projected peak flows are not expected to change through 2050
*See Figure 4.1 on Page 4-13

Table 4.6: Structural Repair and Sediment Removal Needs for Interceptors and Trunk Sewers

Detroit River Interceptor	
Location	Known Issues
Randolph to Beaubien	700 ft. of sediment buildup 24 in. deep
Shelby to Bates	950 ft. of hairline cracks
North Interceptor - East Arm	
Location	Known Issues
	1,050 ft. of sediment deposition
Connor Creek Enclosure	
Location	Known Issues
	5,000 ft. of sediment deposition
Conant-Mt. Elliot	
Location	Known Issues
7 Mile Rd.	3,900 ft. of sediment buildup 7 in. deep
Baby Creek Enclosure	
Location	Known Issues
Rouge River to Vernor	4,100 ft. of sediment buildup 51 in. deep
Southfield	
Location	Known Issues
330' S. of Warren	50 ft. of debris buildup (20-30 cyd.)
Tireman to Warren	2,600 ft. of sediment buildup 12 to 24 in. deep
200' S. of Tireman	200 ft. of debris buildup about 3 ft. deep
Dover to Tireman	3,450 ft. of debris buildup about 12 in. to 24 in. deep
S. of Plymouth to S. of Chicago	100 ft. of large rubble
611' S. of Fitzpatrick	50 ft. of large rubble
N. of Schoolcraft to S. of Davidson	2,100 ft. of debris (about 40 cyd.)
Rembroke to 7 Mile Road	2,600 ft. of sediment buildup 12 to 24 in. deep
650' S. of Paul	50 ft. of crack open to soil
1,700' to 2,100' S. of Paul	450 ft. of minor joint leaks
330' S. of Whitlock	100 ft. of sewer failure (2-3 ft. fall)
500' to 600' S. of Dover	100 ft. minor hairline cracks
180' to 240' N. of Dover	100 ft. of numerous cracks (some open 1 in. with measurable offsets
Fitzpatrick to Dover	1,400 ft. of hairline cracks
N. and S. of Acacia	800 ft. of numerous hairline cracks in crown
N. of Schoolcraft to S. of Davidson	2,050 ft. of cracking and spalling from crown to invert. Scouring of invert. Construction joints open to 1/2 in.
Garfield/Romeo Interceptor	
Location	Known Issues
	1,300 ft. sediment deposition 12 in. deep
15 Mile Road Interceptor	
Location	Known Issues
	2,600 ft. of sediment deposition 10 to 20 in. deep
Edison Corridor	
Location	Known Issues
	1,750 ft. sediment deposition 10 in. deep

Figure 4.2: Relief Sewer Needs Identified in 1978 DWSD Relief Sewer Study



cleared. An impediment to this is that many of these are located in alleyways and backyards preventing easy location of manholes and access. Assess where the restrictions in drainage capacity exist: are they in the service connections, the lateral sewers, the connector sewers or the trunk sewers. Part of this assessment work must refine information the direction of sewer flow. The current CS-1364 infiltration/inflow project has found locations where existing records are not clear on flow direction.

- Capacity Analysis – Once the sewers are cleaned in each problem area, a capacity analysis can most readily be performed with a series of depth recording gages to determine hydraulic grade lines during storm events.

- The Wastewater Master Plan Hydraulic Model, extended from the GDRSS model and developed for this Master Plan, is a planning level tool for the major pipe elements, but in most areas of Detroit does not allow DWSD to review local capacity issues which often are the cause of local flooding issues. Further extensions to the Wastewater Master Plan model should be developed as needed to analyze local capacity issues if the cleaning and hydraulic grade line monitoring is not conclusive. The modeling approach can also be used to evaluate other options to reduce peaks, such as source control (downspout disconnection, cisterns) and inlet restrictors.

After all of the preceding investigation work is completed, prioritize the problem areas and design improvements. If new relief sewers are determined to be required, the construction of these should be carefully sequenced with work for the Long Term CSO Control Program that affects the particular sewer district in the city.

Begin design of a gravity sewer to replace the 15-Mile Road Interceptor and Force Main and to convert the Clintondale pump station to a lift station. Proceed with construction of these facilities so that work is completed by 2015, or before the third phase of the North Gratiot Interceptor is constructed. See Figure 4.3.

Middle Period

In the period 2016 to 2030, perform construction to address structural defects identified in the inspection and condition assessment program for interceptors and trunk sewers.

Perform an engineering study of a sewer parallel to the Oakwood Interceptor from Fort Street to the north end of the siphon under the Rouge River. The purpose of this sewer is to provide a second conduit (approximately 7-foot diameter) for dry weather flows so that the Oakwood Interceptor can be dewatered, inspected and rehabilitated. The route of the new sewer should be planned in conjunction with the proposed greenway and bicycle path envisioned in the Rouge River Gateway Master Plan.

As force main connections are constructed from the pump stations that will dewater the Upper Rouge CSO Tunnel and Dearborn CSO Tunnel, perform inspection of sections of the Northwest Interceptor in the vicinity of the connections.

After the Upper Rouge CSO Tunnel is constructed, perform rehabilitation of portions of the Northwest Interceptor.

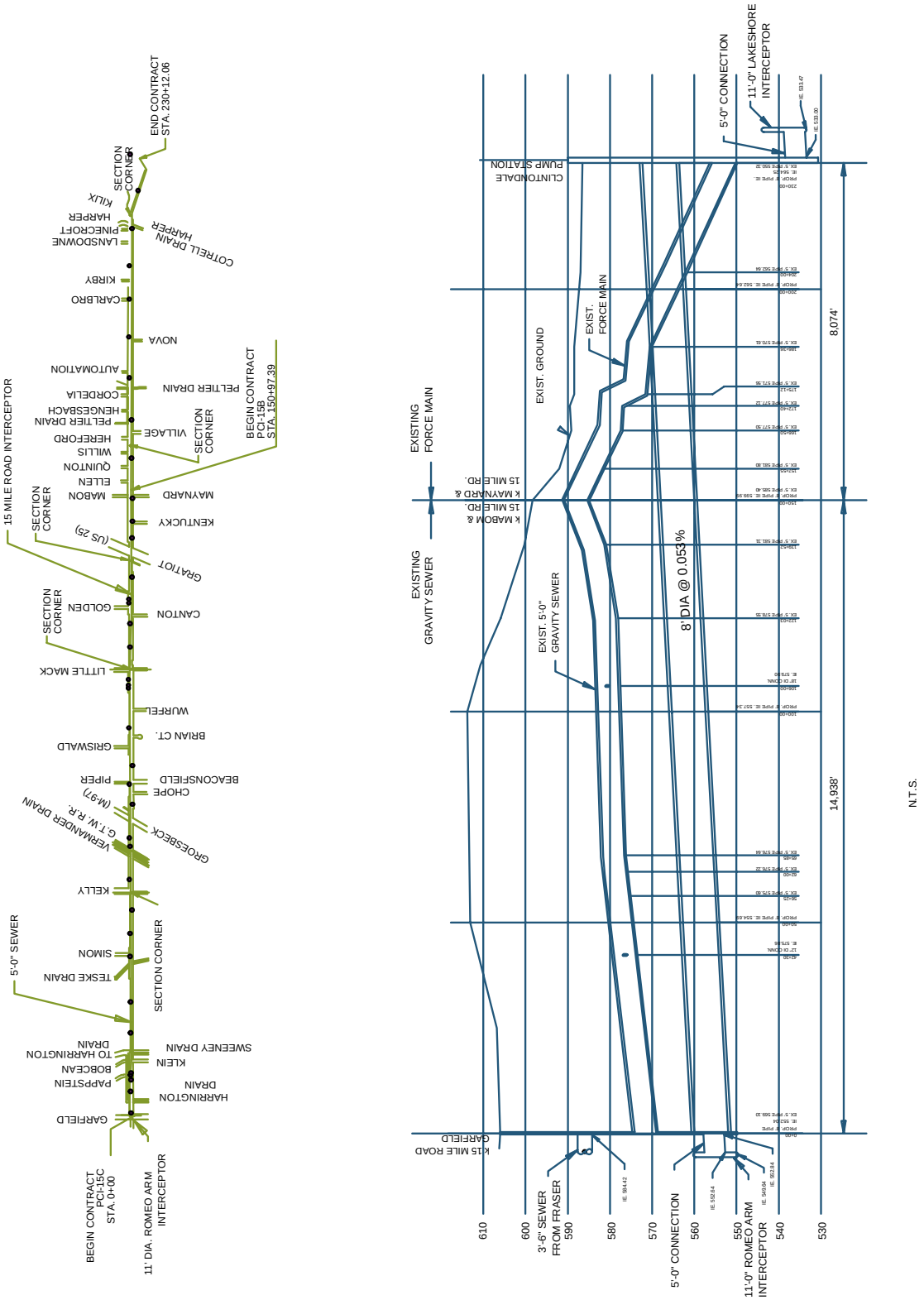
Late Period

In the periods 2031 to 2050, the objective of this program is to complete the third round of structural repairs and to determine a future rehabilitation/replacement schedule for the interceptors and trunk sewers.

4.3.5 Manholes & Catch Basins

This program includes inspection, rehabilitation, and replacement of the sanitary sewer manhole structures in Detroit. It also includes the cleaning, sediment disposal, and condition assessment of

Figure 4.3: 15-Mile Road Interceptor



Detroit catch basins. The goals of the manhole and catch basin program are:

- Perform comprehensive inspections of all manholes within the DWSD system to determine safety for traffic loads and to determine structural and hydraulic conditions, such as dry weather infiltration/inflow sources.
- Rehabilitate/replace manholes to extend the useful life by 50 years.
- Start routine cleaning/maintenance program for catch basins.
- Ensure adequate construction of manholes and catch basins through revised construction standards and specifications.
- Coordinate with disease prevention (West Nile Virus) program by the Department of Health.
- Develop and organize data on Detroit's manholes and catch basins for an asset management program and prepare annual reports.

Early Period

In the period 2004 to 2015, the objective of the program is to start an inspection/ conditional assessment program of the sanitary sewer manholes and catch basins within DWSD's system.

Evaluate whether a manhole inspection program should be incorporated into contract CS-1325, Inspection and Rehabilitation of Existing Circular Sewers and contract CS-1368, Inspection and Rehabilitation of Existing Circular and Non-circular Sewers. The evaluation should determine if it is cost-effective to combine programs.

Begin a manhole inspection program. The manhole inspection program should be geographically coordinated with the sewer program, and should immediately proceed, or follow the sewer program, if it is not included as part of the program. Develop a data collection form for each manhole. Over a three- to five-year period, work up to an annual rate of approximately 2,500 to 3,000 manholes per year, which is 2.5 percent of all manholes on an annual basis.

Review and revise manhole and catch basin construction standards in *Division III: Guidelines for Sewer System Design and Detailing in the City of Detroit*, and *Division IV: Guidelines for Sewer System Construction in the City of Detroit, General and Detailed Specifications*. The new standards should incorporate the latest technology and design standards for manhole and catch basin construction, including leak testing for manholes. See Table 4.4 for a list of the recommended revisions to the design and construction standards.

- Start a catch basin inspection and cleaning program aimed at cleaning and inspecting all catch basins every three to five years. It is estimated that there are approximately 200,000 catch basins in the City of Detroit. This program would include:
- Classify all catch basins into one of five categories:

1) **Critical** -- those catch basins where street flooding is a problem to traffic, public safety, or property damage, and the catch basin must be kept clean for maximum hydraulic capacity;
2) **Non-Critical** -- those catch basins where street flooding is not a significant problem;
3) **Flow-restrictor** -– those catch basins where a designed flow restriction device has been installed to minimize the inlet capacity to alleviate basement flooding;
4) **Mosquito Control** -- those catch basins which have prolonged periods of standing water and need to be controlled for West Nile Virus.
5) **Abandoned** – those catch basins which have been abandoned for their original design purpose due to changes in the sew system, roadways, or land use.

- Expand the existing catch basin cleaning program over a number of years so that all catch basins in the Critical, Flow-Restrictor, and Mosquito Control categories every 3 years.
- Identify catch basins that need to be cleaned on a more regular basis than every 3 years.
- As part of the cleaning program, locate all catch basins with GPS, including a numbering system, the category of the catch basin, and an inspection and cleaning database that is connected to the GIS system (See GIS & Computer Systems Program, Section 4.x.xx).
- Coordinate with West Nile Virus prevention program under Section 4.x.xx Environmental Protection.

A study in southern California found mosquitoes in many different stormwater best management practice structures. The study found that technologies that maintained permanent standing water, such as sumps or basins, provided an excellent habitat for mosquitoes. Best management practices that drained rapidly rarely had mosquitoes. Examples of best management practices that drained rapidly are; biofiltration swales and strips, Austin-type sand media filters, infiltration basins and trenches and extended detention basins. If structures drain in 72 hours, they are not a significant source of mosquitoes.

Excluding mosquitoes has also been effective in reducing mosquito larvae. A below-ground sump was mosquito-proofed in California by sealing off all entry ports with foam seals on the lids and fine mesh nets on the effluent pipe.

To reduce the mosquito population in the DWSD sewerage system, the following actions are recommended:

- Generally good housekeeping that minimizes access of mosquitoes to the inside of buildings will prevent mosquitoes' access to water or wastewater that is needed for laying eggs.
- Provide information on West Nile Virus source reduction tips and other helpful information for homeowners in the DWSD water bills sent during April to August.
- Develop educational material for DWSD employees to familiarize them with larviciding, methods to prevent breeding of mosquitoes, personal protection measures and value of reporting to local health departments the location of dead crows and blue jays that they might come across.
- Apply larvicide to catch basins that hold water in April, July and August. There are larvicides that are effective for 150 days. If one of these is used, one application might be enough for the year. New York City applies larvicide twice a year to 150,000 catch basins.

Middle Period and Late Period

In the periods 2016 to 2030 and 2031 to 2050, the objective of this program is to complete the inspection of all manholes, report on major findings, and inspect and clean all catch basins on a cycle appropriate to their classification. Specific recommendations are:

- Initiate second round of inspections in conjunction with sewer inspection program.
- Evaluate first round of repairs on manholes and reevaluate manhole replacement criteria.
- Continue to inspect and clean all catch basins at appropriate intervals.

4.3.6 Regulators, Outfalls, Backwater Gates, and In-System Storage

This program includes the inspection, rehabilitation, and replacement of flow regulators, outfalls, backwater gates, diversion dams and in-system storage devises to meet performance standards. The goals of the regulators, outfalls, backwater gates, and in-system storage are:

- Inspect infrastructure on a routine basis to en-

sure optimum system function.

- Rehabilitate or replace any deficient structures.

- Ensure optimum performance of system facilities in accordance with the requirements of the Long Term CSO Control Program and System Control projects. These facilities are critical for the operation of the combined system to minimize combined sewer overflows, prevent dry weather overflows, and to minimize inflow from receiving waters.

Early Period

Complete repairs identified in previous inspections of regulators and outfalls done under CS-1158 for the facilities listed in Table 4.7.

Develop a routine inspection program for these wastewater system facilities and an asset management program for maintenance and rehabilitation. Identify a required inspection and maintenance interval for each class of facility.

Complete the evaluation and assessment of these facilities in accordance with the Long Term CSO Control Plan and System Control projects.

Middle Period and Late Period

In the periods 2016 to 2030 and 2031 to 2050, the objective is to continue the inspection, maintenance, and rehabilitation program for these facilities. Install additional remote monitoring and control where cost-effective for enhancing automatic control of the system.

4.3.7 Pump Stations

This program includes the inspection, condition assessment, rehabilitation and major rehabilitation of all the pump stations DWSD owns or operates. The goals of the pump station program are:

- Continue comprehensive inspection program according to PC-744 Asset Audit, LTCSO Plan, and additional capacity studies.

- Continue to analyze hydraulic capacity.

- Develop and organize data on all pump stations for an asset management program and prepare annual reports.

- Provide accurate data on the rehabilitation work for the Asset Management Program.

- Meet upcoming requirements for CMOM (capacity, maintenance, operations, and management)

Early Period

In the early period 2004 to 2015, the objective of the program is to complete rehabilitation work identified by the PC-744 Asset Audit. Current programs for inspection, condition assessment, and associated data management and reporting on all pump stations owned and operated by DWSD should be continued. Specific recommendations are:

Complete repairs of critical defects identified in the PC-744 Asset Audit.

Install flow meters to measure flows at all major pump stations.

Annually update statistics on flows and pump running times at each pumping station, and plan upgrades as needed to meet projected flows. Table 4.8 shows flow projections and upgrade recommendations for each pump station developed from information available for this Master Plan.

Continue inspection of pump stations in accordance with its current Asset Audit program under PC-744. The Asset Audit should be expanded into a Condition Assessment and Restoration program similar to that started for the Wastewater Treatment Plant. This would include:

- Reviewing past inspection procedures and determining if improvement could be made.

- Inspection of the structures.

- Reviewing compliance with regulations (e.g. Clean Air Act, confined space entry, OSHA).

- Testing pump efficiency for all pumps.

Table 4.7: Regulators and Outfalls in the DWSD System

Outfalls

River Rouge District

Warren At Rouge River	Needs Access Manhole Upstream of Sewer BWG.
Pulaski & Jefferson	East Barrel Collapsed & Full Of Debris.
W. Chicago & Rouge River (Outer Drive)	Debris Partially Blocking Opening To River.
Fullerton & Rouge River (Schoolcraft)	Minor Cracking In Crown
Jeffries Fwy. & Rouge River (W. Parkway)	18"-24" Sediment In Both Barrels At River Outlet
Glenhurst & Rouge River	Misaligned Pipe Segments (Offset 4" To 6")
7 Mile & Berg	Rough Concrete Work: Minor Cracking & Spalling
Frisbee & Berg	Minor Cracking & Spalling

Central District

Orleans & Franklin (West)	End of outfall covered with riprap.
Riopelle & Franklin	West: 1 layer of brick missing at 3 and 9 o'clock positions at 650-700 ft and 850-990 ft from dam. East: Brick layer missing from ceiling and side at 840-890 ft from dam.
Schweizer & Franklin	Brick damage at 260-315 ft from dam.
Griswold & Woodbridge	Inspected in 1988 and reinspected in 1995. 1995 Results: Exposed rebar (2' wide x 4' long x 8" deep) in pipe ceiling near manhole 440' from river.
Cabacier & Jefferson	Outfall filled with sediment; not inspected.
11th & Jefferson	Generally OK: Two small holes in West barrel at 350 ft from dam.
12th & Jefferson (Rosa Parks)	Inspected in 1988 and reinspected in 1995. 1995 Results: 10' x 6' x 3.5' washout in west barrel at 290 ft from dam.
14th & Jefferson	Some brick damage to first layer of brick and one small hole in brick in east barrel.
18th & Jefferson	Damage in both barrels 0-20 ft from river. Hole in west barrel at 370 ft from dam.
21st & Jefferson	Crown infiltration through missing mortar at 760' from dam.
24th & Jefferson	Two 66" outfall barrels to be lined with in-situ pipe
W. Grand Blvd. & Jefferson	18th Gravel deposit at end of outfall.
Swain & Jefferson	West: Bulkheaded at upper end and has sediment. East: Cracks and exposed rebar between 100 and 270 ft from river.
Scotten & Jefferson	Brick damage in both barrels between 80-150 feet from river.
McKinstry & Jefferson	West: At 625' from dam, one 10" sq. hole between barrels. East: Heavy damage at 620-650 ft from dam. Many areas of minor damage in both barrels.
Summit & Jefferson	Outfall OK except 2" and 3" wide cracks at 530' to 670' from BWG to river in east barrel.
Campbell & Jefferson	All 3 barrels have holes connecting barrels 0-20 ft from river. East barrel has damage at 150-160 ft from river.

Table 4.7: Regulators and Outfalls in the DWSD System (continued)

Outfalls	
Central District	
Dragoon & Jefferson	Needs access manhole near Jefferson. Significant sediment in west barrel.
Schroeder & Jefferson	Brick damage 870 to 880 ft from dam in west barrel. Some cracks and missing brick in east barrel.
Flora & Reisner	Outfall full of sediment.
East Jefferson District	
Ashland (Fox Creek)	West barrel – exposed rebar in ceiling (2' x 2')
Freud Pump Station	Debris in stop log slots; not inspected. Needs access MH between stop logs and pump station.
Backwater Gates	
River Rouge District	
Warren & Pierson	Top of the timbers are deteriorating. Warped wooden gate does not seal (No. 1).
Tireman & Trinity	Tops of the timber gates are rotting.
Fenkell & Rouge River	Gate requires disassembly and cleaning.
Glenhurst	There is an accumulation of grout that should be removed.
Central District	
Jos Campau & Franklin	Deterioration of brickwork under frames of backwater gates.
Franklin & Rivard	Concrete debris is keeping river gate open
Jefferson & Randolph	River gate has fallen down, hinge is broken.
Jefferson & Woodward	All gate hardware needs to be replaced.
Jefferson & Griswold	Retention washers and cotter pins are missing on sewer gate.
Jefferson & Third	Some cotter pins and hinge pins are missing or misaligned. There are concrete chunks near the center river gate.
Jefferson & Dearborn	The wood in the sewer gate is deteriorated and spongy.
Carbon & Rouge River	The grout between the frame and masonry headwall has washed out.
Outfall Flow Regulators	
Central District	
Jefferson and Leib	Remove loose deteriorated concrete if there is any and clean concrete surfaces. Fill float chamber with lean concrete or flowable fill up to top of regulating chamber base slab. Provide 8" diameter pipe sleeve, completely grouted in the bottom of wall between float chamber and regulating chamber to avoid standing sewage water due to overflow in regulation chamber.
Franklin and Chene	Fill float chamber with lean concrete or flowable fill up to top of regulating chamber base slab. Provide 8" diameter pipe sleeve, completely grouted in the bottom of wall between float chamber and regulating chamber to avoid standing sewage water due to overflow in regulation chamber.

Table 4.7: Regulators and Outfalls in the DWSD System (continued)

Outfall Flow Regulators	
Central District	
Franklin and Aubin	Fill float chamber with lean concrete or flowable fills up to top of regulating chamber base slab. Provide 8" diameter pipe sleeve, completely grouted in the bottom of wall between float chamber and regulating chamber to avoid standing sewage water due to overflow in regulation chamber.
In-System Storage Devices	
Rouge District	
Warren & Pierson	Rehabilitation of manhole frame and cover
Central District	
W. Jefferson & Dragoon	Replace Control Gate with Slide gate; Rehabilitation of Chamber concrete surfaces; Construction of new cast-in-place reinforced concrete structures in the chamber; Replacement of access manholes, frames and covers; Install new manhole steps, ladders, grating and supports.
W. Jefferson & Dearborn	Brickwork under M.H. frame needs rehabilitation.
Miller Rd. - Baby Creek	Replace Control Gate with Slide gate; Rehabilitation of Chamber concrete surfaces; Construction of new cast-in-place reinforced concrete structures in the chamber; Replacement of access manholes, frames and covers; Install new manhole steps, ladders, grating and supports.
Diversion Dams	
Franklin & Orleans	Flashboard: Remove existing 2" x 4" stop logs and replace them with 4" x 4" logs in the same quantity.
11th St. & W. Jefferson	Flashboard: Make good contact between top of Dam surface and bottom of Flashboards.
McDougall & Franklin	Clean Deteriorated Surfaces: Apply repair mortar Sika-top SF by Sika Corporation or equal to finish surface. Apply bonding coat between existing concrete surface and new repair mortar.

Table 4.8: Hydraulic Capacity Analysis of Major DWSD-Operated Pump Stations

District Served	Pump Station**	Existing (2003) Firm Capacity (cfs)	Planned (2050) Firm Capacity (cfs)	Projected Peak Flow Rate to PS (cfs)*				Comments
				2020		2050		
				Winter	Summer	Winter	Summer	
Fox Creek	Bluehill, Storm & Sanitary	790	same	790	790	790	790	Peak inflow rate = peak pump capacity
Macomb	Clintondale, Sanitary	80	120	57	41	60	44	Capacity of existing force main marginal with today's flows for events larger than design event Recommend replacing with gravity sewer by 2020 or before additional segments of NGI are constructed. This upgrade will allow increase of firm capacity of pump station to 120 cfs, as also recommended
East Jefferson, Fox Creek, & east-side suburbs	Conner, Storm & Sanitary	4,095	same	2,601	2,595	2,548	2,566	Additional capacity not projected to be required
East Jefferson, Fox Creek, & east-side suburbs	Fairview	375	same	0 / 375	0 / 375	0 / 375	0 / 375	Currently throttles flows to 0 during peak of evnt for 1 - 2 hrs, causing backup & discharge to Conner Basin
East Jefferson, Fox Creek, & east-side suburbs	Freud, Storm & Sanitary	3,540	same	3,595	3,592	3,601	3,589	Peak inflow exceeds PS rated capacity, but only minimally-additional capacity not projected to be required
Clinton-Oakland & Macomb	Northeast, Sanitary	250	400	308	238	323	254	Current planned improvement is expected to be in place by 2005
Oakwood	Oakwood, Storm & Sanitary	406	same	406	406	406	406	u/s hydraulics not modeled; peak inflow rate = peak pump capacity; pump station and u/s sewers to be refurbished/rebuilt in near-term future
Baby Creek	Woodmere, Storm & Sanitary	520	776					Pump 4 to be installed in future, date undetermined. Peak flows not included in model, functions as a lift station into Baby Creek

*Peak Flow associated with 10-year, 1-hour design storm event, from WWMP Model
**Sanitary and storm pump capacities are combined in this table, as comparing total firm capacity of the PS, both sanitary and storm, if applicable, to total flow being delivered to the pump station

- Reviewing electrical and instrumentation equipment.
- Replacing worn parts (mechanical).
- Maintaining a database with all components in the stations and a rehabilitation schedule for each component. Develop and organize data for an asset management program and prepare annual reports.
- Establishing a classification system to identify importance of repair (e.g. immediate; within one month; soon; within the year; in the future ; + 1 year out).
- Developing a capital replacement and capital improvement program for the pump stations. A key consideration for future capital expenditures should be the ongoing need for greater operational control of the pump stations. Table 4.9 lists recommended pump station upgrades.

Middle Period and Late Period

In the periods 2016 to 2030 and 2031 to 2050, the objective is to maintain operation of the pump stations through the asset audit program, improve operational efficiency, and complete improvements where needed:

- Add capacity to pump stations based on operating requirements and requests from customers.
- Continue improvements in system controls and energy management.

4.3.8 Meters and Billing Data

This program includes the inspection, rehabilitation, replacement, data collection and operation of the billing meters and master flow meters within the DWSD's system. There are several goals for the meter program:

- Perform annual inspections and calibration of all flow meters to provide accurate billing and flow measurements.
- Rehabilitate / replace flow meters as needed to maintain accurate measurements.
- Ensure individual meters meet capacity requirements.
- Collect accurate metering data in accordance with procedures established by the DWSD's Flow Metering Task Force.
- Where possible, install meters in unmetered areas.

Early Period

In the period of 2004 to 2015, the objective of this program is to inspect and calibrate all meters on an annual basis. Specific recommendations are:

- Complete all renovations and repairs of existing meters identified through the current meter maintenance program, including structural repairs and

Table 4.9: Recommended Pump Station Upgrades

Map # **	District Served	Pump Station	2003 Capacity	Increase Project Underway	Projected Peak Flows (cfs) (10-yr/1-hr event) 2020	2050	Comment/Recommendation
1	Macomb/ Clinton-Oakland	Northeast	250 cfs firm	+ 150 cfs pump	238	254	Current planned improvement expected to be in place by 2005
2 & 3	Macomb	Clintondale PS & Force Main	80 cfs firm		41	44	Capacity of existing force main marginal with today's flows for events larger than design event.*

*Recommend replacing with gravity sewer by 2020 or before additional segments of NGI are constructed. This upgrade will allow increase of firm capacity of pump station to 120 cfs, as also recommended.

**See Figure 4.1 on Page 4-13

rebuilds.

- Identify all inspection criteria for each meter and supporting infrastructure.
- Determine level of accuracy for each meter (minimum for billing and minimum before replacement.
- Run cost analysis on meter accuracy error to determine optimum time between calibrations.
- Develop and organize data on Detroit's flow meters for an asset management program and prepare annual reports. Establish detailed procedures for inspection and calibration of meters.
- Maintain the Flow Meter Task Force to include customers and other flow metering professionals involved in the work of certifying performance of the meters used in the DWSD collection system.
- Review and manage the flow data collected by all meters used for billing and for managing flows within the DWSD collection system using the principles developed by the Flow Metering Task Force in the "Good Metering Practice" guidelines. Use this process to generate the best available information needed to prepare customer bills and reviews of the performance of the collection system.
- Install Acoustic Doppler Flow Meters to measure flows in the interceptors upstream from the treatment plant. Meters should be installed in each of the influent interceptors to provide direct flow measurement entering the WWTP. These meters should be tested and maintained on an annual basis using the "Good Metering Practices" developed by the GDRSS Flow Metering Task Force.
- Evaluate the responsibilities of DWSD and Macomb County for meter operation in Macomb County. Currently, DWSD owns and operates

Table 4.10. Recommended Meter Upgrades and Recommended New Meters

Map # ***	District Served	Facility Name	2003 Capacity	Projected Peak Flows (cfs) 2010	2020	2030	2040	2050	Comment/Recommendation
11	Chesterfield	CH-S-5	40	20.2	23.5	26.9	29.4	31.9	May need to be replaced or reconfigured when North Gratiot Interceptor is built.
11	Clinton Township	CT-S-3	15	13.5	14.5	15.5	16.3	17.1	If flows exceed 15 cfs as projected, will need to reset calibration range of meter -- potential meter capacity = 35 cfs.
12	Clinton-Oakland	OC-S-2	86		72			78	Improper hydraulic conditions. To be upgraded under contract PC-721
13	Rouge Valley	WC-S-2	94.5		80			95	Wayne Co. planning to replace meter.
14	Rouge Valley	WC-S-3	100		71			72	Wayne Co. planning to replace meter.
15	Clinton Twp.	Unmetered Area		1.7	2	2.2	2.3	2.4	Not currently metered. Install meter.
16	Clinton Twp	Unmetered Area		7.6	7.4	7.2	7.2	7.3	Not currently metered. Install meter.
17	Fraser	Unmetered Area		1.8	1.8	1.8	1.9	1.9	Not currently metered. Install meter.
18	Grosse Pt. Farms	Unmetered Area		5.9	5.8	5.6	5.6	5.6	Not currently metered. Install meter. **

*10-year, 1-hour event as determined from model or calculated flow need
**Flow meter recommended by Flow Metering Task Force for sanitary pumps. Pump curves to be used to estimate flows from storm pumps. pumps. Currently being investigated.
***See Figure 4.1 on Page 4-13.

flow meters serving communities in Macomb County, and this arrangement is different from that in Wayne and Oakland counties. The evaluation should consider cost-effectiveness, ability to conform to metering standards, and cost allocation issues.

Table 4.10 lists meters that currently are being upgraded or replaced and meters for which projected flows are expected to exceed the capacity of the meter in the future. The existing capacity of the meter is provided, along with the projected future flows expected to be measured at that location. In addition, four areas are noted as currently not being metered. The Chesterfield meter, CH-S-5, has capacity for projected future flows, but it will need to be replaced or reconfigured when the planned North Gratiot Interceptor is built, with a new connection at the current location of the CH-S-5 meter. There are two meters downstream of this meter, MC-S-1 and OM-S-2, which measure these flows as well as flows from other areas. These meters are not billing meters, but they do have the capacity for the projected future flows as they are design to handle full pipe flow.

Middle Period

In period 2016 to 2030, the objective of this program is to reevaluate flow meter capacity, inspect and test all meters, and replace mechanical components and defective structures. It is expected that all meters will need to have their electronic components replaced within this period as newer technologies become available.

All flow meters that are expected to be at capacity must be replaced with larger meters. Identify growth areas with increased flows. The meters in these areas will need to be reviewed for future capacity issues and a timeframe identified for replacement.

Develop a long-term strategy for performing the data management by DWSD staff or contracting to an independent contractor that maintains the standard developed by the Flow Metering Task Force.

4.4 CSO and SSO Controls

The combined sewer overflow and sanitary sewer overflow controls area is comprised of two programs:

- Long Term CSO Control Plan
- Sanitary Sewer Overflow Control

4.4.1 Long Term CSO Control Plan

DWSD has been implementing its Long Term CSO Control Plan (LTCSO Plan) since 1996 to achieve compliance with CSO discharge requirements of the NPDES permit.

Early Period

This Master Plan assumes that recommendations of the 1996 LTCSO Plan, and its December 2002 Update, will be carried-out in accordance with the schedule of the NPDES permit. Cost estimates and sewer rate impact estimates prepared for the Master Plan are based on the results of the LTCSO plan. When the LTCSO Plan is updated in 2008, DWSD should review the programs and cost estimates presented in that plan and update this Wastewater Master Plan accordingly.

Middle and Late Periods

Continue implementation of CSO controls in accordance with the recommendations of the 2008 Update to the LTCSO Plan and subsequent updates.

4.4.2 Sanitary Sewer Overflow Control

The Sanitary Sewer Overflow (SSO) program is designed to help DWSD's customer communities correct their sanitary sewer overflows. This Master Plan evaluated sanitary sewer overflows in the DWSD service area and identified a series of alternatives for SSO control. The alternatives range from elimination of peak wet weather flows by disconnecting footing drains, to constructing stor-

age basins, to regional alternatives involving additional displacement of combined sewer flows to CSO control facilities.

Regional Alternative "A" increases customer community contract capacities to a technical standard based on the 10-year 1-hour storm flow and the age and type of the collection system. Communities are responsible for work in their systems to reduce flows or store flows to control SSO in accordance with MDEQ policy.

Regional Alternative "B" increases several customer community contract capacities to a flow rate greater than the technical standard established in Alternative "A". The several customer communities included in Alternative "B" that would have higher contract capacities are located such that there is very minimal or no additional displacement of combined sewer overflow beyond which currently occurs in the regional system. The additional displacement under Alternative "B" is estimated to be 1.2 million gallons per year, based on a continuous modeling simulation of 40 years of rainfall. All of this additional discharge is from the Baby Creek CSO screening and disinfection facility, so there would be no increase in untreated CSO discharges.

Regional Alternative "B" has a total cost savings of $40 million compared to other alternatives. It is recommended that DWSD and its customer communities with SSOs approach the MDEQ to discuss the acceptability of this alternative. The MDEQ SSO Policy of December 2002 does not speak to the issue of displacement.

Early Period

DWSD is not required to help its customers with their SSO problems. However DWSD has undertaken cooperative efforts to assist its customers to find an optimal low-cost solution. Costs for SSO correction will be paid by the respective customer. DWSD's wholesale customers with sanitary sewer overflows should, in conjunction with efforts underway through the DWSD First Tier Partnering Steering Committee and associated work groups, undertake the following actions:

- Initiate, or continue MDEQ's "Short Term Measures" and other "Best Practices for System Maintenance" identified in Volume 6 of this Master Plan plus other practices, including: Perform periodic cleaning and televising of sewers (5-10 years)
  - Review manholes and have a cross-connection program
  - Establish a program for rehabilitation and replacement of defective system components
  - Develop ordinances and supporting inspection and enforcement programs for reconnected sump pumps, downspouts, etc.
  - Perform periodic flow monitoring to understand performance and reductions form rehabilitation work, as well as identify areas and sources of high I/I
- Where necessary, develop a corrective action plan in accordance with MDEQ requirements and in accordance with the revised contract capacity and contract terms established with DWSD. (See Customer Service Program).
  - Continued investigation to understand system performance and identify sources of I/I
  - Identify and implement system operation efficiencies
  - Identify and implement cost-effective I/I reduction techniques.
  - Identify and construct storage, pumping facilities, and relief sewers as needed.

DWSD should undertake the following actions:

- Adopt or revise "allowable 10-yr 1-hr flow" calculations through its Contract Work Group and identify impacts to customers
- Finalize the structure of new contracts to be used

with all by early 2004.

- Review customer proposed long-term wet weather reduction plans, and provide assistance where necessary.

- Establish new contracts and contract limits in 2004 to 2006; use bridge agreements, if necessary before new contracts are put into place.

- Continue to provide technical support and advocacy for customers communities in interactions with MDEQ regarding sanitary sewer overflow compliance.

Volume 6 of this Master Plan, *Evaluation of Regional SSO Controls* report presents additional technical detail on implementation of corrective actions for SSO control.

4.5 Wastewater Treatment Plant

The long term cost projections developed for this Master Plan include an allowance for future plant rehabilitation, equipment replacement, and process upgrades at the wastewater treatment plant after the completion of current upgrade project, PC-744.

The allowance used for this Master Plan is $150 million per year. This allowance is not based on a detailed examination of needs, but it is consistent with estimates provided by the PC-744 project for the near term. The allowance is sufficient to cover costs such as:

- Improvements to biosolids processing handling, disposal or reuse should the Minergy project not proceed as planned;

- Additional needs that are identified by PC-744, but not completed under that project.

- Future upgrades after 2020 to the instrumentation and control system project (PC-713) now underway.

- Future upgrades to respond to new regulatory requirements for air quality and water quality, and to improve treatment process technology.

The management at the Wastewater Treatment Plant and PC-744 consultants are currently developing a process for systematically testing and assessing all plant components, prioritizing projects, and annually issuing a *Condition Assessment and Restoration Report*. Based on this report, and other data on assets gathered in the program (as shown in Figure 4.4), a cost-effective annual capital improvement program should be developed for the Wastewater Treatment Plant.

After this system is deployed and in use, DWSD should use it to more accurately estimate its capital improvement and replacement needs at the plant. In any decade where major process improvements are not planned, the actual needs for

routine replacement and rehabilitation could be substantially less than $150 million per year, based on a review of proposed capital expenditures of other large wastewater treatment plants.

•After the completion of PC-744, additional projects at the Wastewater Treatment Plant will most likely concentrate for the next ten years on areas only partially covered in the PC-744 contract, such as:

- Plant Utilities (see discussion under 4.5.4 Buildings and Grounds)
- Sampling and Monitoring System, and Laboratory Upgrades
- Computer and SCADA Upgrades
- Security
- Safety and Environmental Hazards
- Roads and Parking
- Workplace Enhancements and Accessibility Requirements
- Landscaping and Grounds

Specific recommendations are listed below.

4.5.1 Liquid Treatment Train

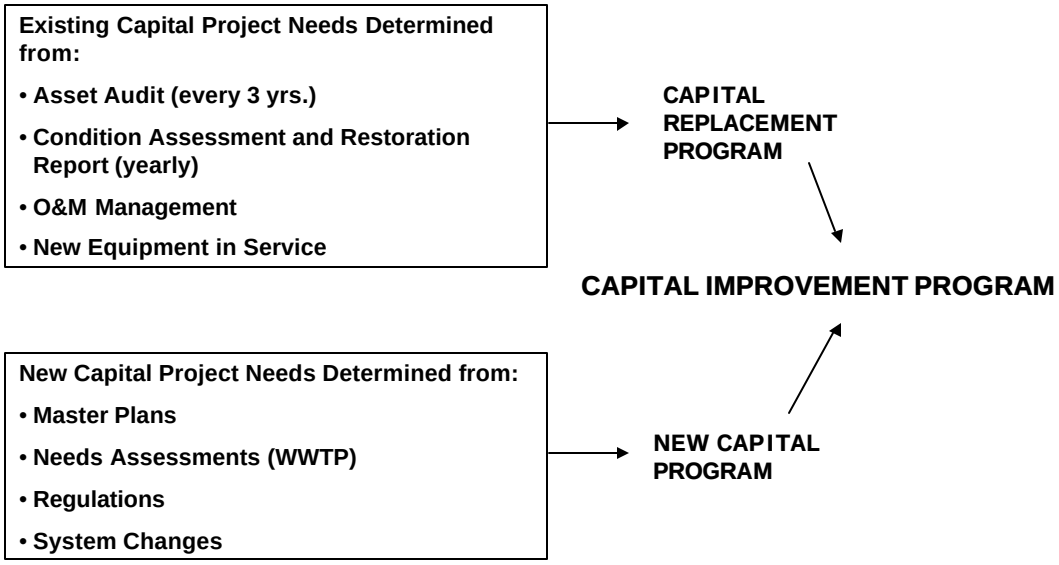
Early Period

Following the completion of project PC-744 (Wastewater Treatment Plant Rehabilitation and Upgrade Program) and other major projects underway at the plant, including DR02, chlorination/dechlorination, and primary clarifier project, prepare and prioritize a list of future improvements to the treatment plant for the remaining years to 2015

Liquid train processes at the plant should be adequate after the completion of PC-744 unless permitting requirements change. Further upgrades should address the most limited liquid train processes at the plant, as identified in the technical memorandum *Review of Detroit Wastewater Treatment Plant:*

- Secondary Clarifiers: The firm capacity of the secondary clarifiers is 930 mgd, with little room on site for expansion.
- Intermediate Lift Stations: ILP 1 and 2 cannot provide the required wet weather capacity flow to Aeration Deck 2.

Figure 4.4: Capital Management Flowchart



• Raw Wastewater Pump Station 2: The rated capacity of the seven existing pumps is low.

Middle and Late Periods

After completion and startup of the Upper Rouge Tunnel and the Conner Creek and Oakwood CSO basins, evaluate the performance of the Wastewater Treatment Plant to meet its NPDES permit effluent limits in dry and wet weather. Should performance not meet expectations, review the option of adding ballasted flocculation technology to the primary clarifiers to improve effluent quality.

Review emerging regulatory requirements and develop a CIP for the treatment plant for 2015 to 2050. The technical memorandum *Conceptual Design for a Future Wastewater Treatment Plant* prepared for this Master Plan and included on the CD that accompanies the plan, provides DWSD with a feasibility-level review of newer technology that would allow for substantial improvements for operational efficiency and some additional treatment capacity at the current site. Also review site development concepts included in the *Wayne County Rouge River Gateway Master Plan of 2001*.

4.5.2 Biosolids

Early Period

Assess the status of the Minergy project and development of alternatives to the Minergy project, if needed. The technical memorandum *Long Term Solids Disposal Alternatives for the Detroit Wastewater Treatment Plant* prepared for this Master Plan provides DWSD with a feasibility review of alternatives for biosolids management.

Middle and Late Periods

If there is a change from the Minergy project, then DWSD should consider the following evaluation of options:

• Perform detailed evaluations between the multiple hearth incineration (MHF) and fluidized bed incineration (FBI) with energy recovery. Identify the detailed upgrade needs, life-cycle cost analysis, and operation and maintenance evaluations of both. This evaluation will answer the question of whether new FBI or upgrade existing MHF meets the DWSD's long-term goal better.

• Conduct immediate study on the market conditions for Class A and Class B biosolids, and feasibility investigation into the reclamation application issues and feasibility.

• Evaluate the offsite solids handling facility possibility, particularly with anaerobic digestion as the core process unit.

4.5.3 Regional Operations and SCADA

Early Period

Upon completion of the Regional Operational Plan, currently planned for August 2003, work with customers and internal staff to implement the plan. Prepare annual reports with input of customers and internal staff on progress achieved, results, problems encountered, and recommended corrective actions.

Adapt the Regional Operational Plan (and its annual reports) to become part of the Operational Plan Update that DWSD prepares annually in fulfillment of requirements of its NPDES permit.

At the completion of Project PC-713, assess future needs and identify capital improvement and staffing needs to the year 2015.

Middle and Late Periods

Review operational requirements and prepare 10-year plans for ongoing operation and upgrades to the SCADA system and operational plan.

4.5.4 Building and Grounds

Early Period

In addition to improvements in wastewater service and treatment, DWSD should strive to im-

prove operations and save costs by maintaining the building and grounds of the wastewater treatment and pumping facilities. The work at the Wastewater Treatment Plant under PC-744 (Wastewater Treatment Plant Upgrade) has concentrated on improvements in process units, with building utility and infrastructure improvements added to process improvement projects where possible. Additional work on the utilities at the plant (water, sewer, electrical, computer networks, etc.), security, roads, landscaping, and other components will also be required to keep the plant functioning.

The PC-744 *Needs Assessment, Rev. 3* documents the plant utilities requirements in Section 4 of the report, and recommends an as-needed contract to address these problems as they come up. Other work described in this report, such as cleaning of sumps and manholes, could possibly be performed by DWSD staff. Similar work should be planned at the CSO facilities and pump stations that are part of the collection system.

In addition to wastewater collection and treatment facilities, DWSD maintains a number of other facilities that are essential to maintenance and operation of the system, such as the Water Board Building, East Yard, Central Yard, Field Services Building, and Customer Service Centers.

In the early period, the objective of a buildings and grounds program should be to improve the overall environment for workers and customers using the facilities, while reducing costs. Specific recommendations are as follows:

- For all facilities, evaluate and address deficiencies in the following infrastructure components (in order of priority): 1) building utilities (water, sewer, electrical, etc.), 2) security, 3) health and safety-related defects, 4) energy-saving improvements, 5) transportation, 6) grounds enhancements.
- Complete, enhance, and maintain the current inventory of buildings and facilities in the DWSD system, and tie to a GIS and database system.
- Develop capital renewal and replacement and maintenance programs for all buildings similar to that developed for the Wastewater Treatment Plant. Enhancements that reduce operating costs, such as energy-saving improvements, should have priority for funding.
- Evaluate current needs for office and plant facilities versus total number of employees, particularly where renting of facilities is required. This assessment should be coordinated with DWSD and City Human Resources Departments.

Middle and Late Periods

DWSD should also look at its facilities in the city as a possible focus point for each sector of the city, and work with the rest of city government and neighborhood groups to provide the best facilities possible. Well-maintained utility facilities are an important asset to a community. Enhancement of these facilities can improve a neighborhood - for example, many communities have built or renovated attractive pump stations to fit into the prevailing architecture of the area.

An example of an important buildings and grounds issue is the future of the Water Board Building. The cost of renovating the Water Board Building versus building a new facility must be considered. On the other hand, there may be an impact on downtown if a new facility is built in another location instead of renovating the current building (or rebuilding on the same site).

4.6 Environmental Protection

The environmental protection area is comprised of four programs:

- Regulatory Compliance and Monitoring
- Industrial Pretreatment and Septage Management
- Flow and Watershed Management
- Facilities on Private Property

Recommendations for each program are presented below. The recommendations are framed with general goals for the program and measurable objectives for each of the three planning intervals.

4.6.1 Regulatory Compliance and Monitoring

This program includes addressing areas to meet existing and upcoming court directives and Federal and State regulations. The goals for this program are:

- Meet all regulatory and permit requirements, and directives of the U.S. District Court.
- Provide accurate testing and reporting of wastewater, air and hazardous waste.

Early Period

- Review the new NPDES permit and refine the list of activities listed below based on the requirements of the permit.
- Participate in regional watershed and source water protection programs that are within the DWSD service area and work with regional stakeholder groups on development of these programs.
- Begin to implement an Environmental Management System (EMS) or seek ISO certification.
- Review utilization of hazardous chemicals and spill prevention and response plans and modify the plans as necessary to ensure compliance with state and federal regulations for handling, use, storage and disposal of hazardous chemicals.
- Support state and/or federal legislation, which would regulate the content of hazardous materials such as mercury in commercial or household products where the products could enter the waste stream. (Note: PCB concentrations have not been shown to have a significant impact on effluent quality. The November 1995 PCB/ Minimization Program reported that low concentrations of PCBs were detected in several parts of the city and treatment plant effluent concentrations were consistently below the detection level. Detectable concentrations of PCBs are only found occasionally in the sludge.)
- Review requirements for renewal of incinerator air quality discharge permit, should the Minergy project not proceed.
- Review sample collection methods and laboratory testing equipment and procedures to improve efficiency and reduce costs. As laboratory equipment manufacturers have obtained approval for new test procedures, they have shortened the time for testing. With a shorter time for testing, more tests can be run as compared to older procedures, and shorter time results in lower laboratory costs. An example would be the reduced time for E. *coli* testing if the new procedures now being tested are approved.
- Review and update monitoring in accordance with any new monitoring requirements of the new NPDES permit currently being prepared. Monitor wastewater, air, disposal of residuals and hazardous materials storage and disposal from DWSD wastewater facilities.

Middle and Late Period

Assess new initiatives for regulatory compliance and monitoring every 5 years.

4.6.2 Industrial Pretreatment and Septage Management Program

This program includes monitoring, testing, and data management of industrial discharges to prevent introduction of pollutants into the wastewater system, plus DWSD's responsibilities to receive and treat septage and other liquid wastes and wastewater treatment plant sludge transported by truck to its regional wastewater system. The goals for the industrial pretreatment and septage management program are:

- Test and monitor industrial waste streams entering the system.
- Provide and maintain septage disposal facilities.
- Manage disposal to comply with state and federal regulations.

Early Period

In the period 2003 and 2010, the objective of the program is to address regulatory changes, implement pretreatment program and conduct monitoring and testing, review current standards and procedures, construct new septage disposal facilities, improve surveillance, security and sanitation, and review rates. Specific recommendations are:

- Survey the communities and counties where DWSD administers the industrial pretreatment program. The purpose of the survey is to provide customers the opportunity for input into the program.
- Complete the revision of Ordinance 34-96 for compliance with Federal requirements. Review of Ordinance 34-96 has been underway for some time. The MDEQ initial review of the local limits revisions was completed April 7, 2003. DWSD is reviewing MDEQ comments and will be preparing a formal submittal to MDEQ.
- Develop a process with customers to update their local ordinances to be equal to Ordinance 34-96 as amended.
- Implement the Pretreatment Information Management System. Review causes of noncompliance and develop educational material for improving compliance.
- Review and adjust local discharge limits as necessary to protect sewerage system.
- Review the current charge of 2 cents per gallon for septage disposal. Change the current city ordinance as required to raise fees to current area standards of 6 to 8 cents per gallon for disposal and compare current charges with the current Schedule of Surcharge Rates used by DWSD. Based on the 2000-2001 Schedule of Surcharge Rates the rate charged for septage disposal would be only 3.2 cents per gallon.
- Construct new septage receiving stations at the DWSD WWTP and support Macomb and St. Clair counties in developing new sites. Upgrade existing septage receiving facilities.
- Review rate charged for septage disposal every two years.
- Convene meetings every two to three years with the public health officials for each county to determine if there is a need for new septage receiving stations. Implementation of these necessary septage receiving stations is anticipated to proceed when there is county support.

4.6.3 Flow & Watershed Management

This program includes capacity management efforts and infiltration/inflow reduction. The goals of the flow and watershed management program are:

- Reduce peak flows through reduction of I/I.
- Assist in determining how to implement flow management for the DWSD system.
- Coordinate components of a comprehensive flow management program.

Early Period

In the period 2003 to 2010, the objective of this program is to reduce flows through education, source reductions, and communicate with suburban customers. Specific recommendations are:

- Accelerate the program to reduce unaccounted-for water. According to the June 2002 draft report *Task C: An Evaluation of Unaccounted-For Water, Comprehensive Water Master Plan, DWSD Contract No. CS-1278*, water system losses from all sources in the City of Detroit are estimated at 30,682 million gallons annually, or approximately 84 mgd. This total includes water losses from pipe leaks, main breaks, meter inaccuracy, fire hydrant use, water treatment plant discharges, and other sources. The proportion of this total that reaches the sewer system is currently unknown, but may be identified in the current Infiltration/Inflow Study that DWSD is conducting. Reduction of even a portion of this flow total could significantly impact the total flow at the Wastewater Treatment Plant (for example, a 20 percent inflow reduction would reduce needed wastewater treatment capacity by 16 mgd).
- Support suburban communities that pursue watershed plans in response to EPA's Phase II storm water permit requirements. DWSD can support suburban communities by sharing with communities information that DWSD has developed such as reducing fats, oils and grease in the sewer system, pollution prevention, PCB/Mercury minimization, and continuing to work with communities on issues related to basement flooding and sanitary sewer overflow control.
- Involve more senior DWSD staff members with engineering and wastewater background in the GDRSS Technical Committee for flow monitoring and modeling.
- Involve more senior DWSD staff members from Suburban Billing Department and the Financial Department in the GDRSS Billing Workgroup.
- Involve more senior staff members with experience in instrumentation in the GDRSS Flow Metering Task Force.
- Measure the impact of flow removal on the sewerage system.
- Identify urban streams that could be day-lighted and review cost estimates and cost savings for day lighting. Include the evaluation of benefits of urban stream restoration in redevelopment reviews.

Middle Period

In this period 2011 to 2030, the objective of the program is to continue to address I/I flow reduction of 50 MGD from the City of Detroit and the customers of DWSD. Other specific recommendations are:

- By 2015, it is estimated that 25,000-75,000 homes in Oakland and Macomb counties may be at risk for failures of on-site disposal systems. These failures may result in an increase in requests for DWSD service to those areas. DWSD staff involved in planning and coordination with suburban systems should periodically meet with Public Works, Wastewater System, and Public Health Directors in these counties to monitor the situation. The option of connecting to the DWSD system could be offered to communities with on-site system operational problems, consistent with the "growth pays for growth" policies of the Department.

Late Period

In the period 2031 to 2050, the objective is to continue to implement new technology to monitor and test waste streams. Other specific recommendations are as follows.

In 2020, 2030, and 2040 evaluate dry weather and wet weather wastewater flow to the treatment plant to determine the need for additional flow and watershed management actions to operate in compliance with regulatory requirements.

4.6.4 Facilities on Private Property

This program includes elimination of the remaining septic tank systems in Detroit, and addressing infiltration and inflow through sewer connections and sewer lines on private property. This program has been identified separately because DWSD will need to work in close coordination with the Detroit Department of Building and Safety Engineering to accomplish the program objectives.

Early Period

Enforce the repair of private service connections to the sewer system. This work should include:

- Establish methods to advise the Building and Safety Engineering Department and track progress on corrective actions when DWSD's sewer inspection work identifies private service connections that are damaged or do not meet code requirements.
- Develop a city ordinance that mandates inspection of private service connections at the time of sale of a property when there has not been such an inspection in the last 20 years. This effort would reduce root intrusion, sediment intrusion, and infiltration/inflow from private service connections.
- Start neighborhood investigations to find existing septic tanks that need to be reached by sewers.
- Identify locations and start the design of the sewers. There is an assumed two miles of sewer needed to provide service to the 100 existing septic tanks in Detroit. As of January 2003, there were 27 properties confirmed by DWSD to have septic tank systems and 56 properties that have not been checked.
- Construct gravity sewers/ pump stations as needed to service properties.
- Require old septic tanks to be abandoned and hook up to new facilities within 90 days of facilities being available.

4.7. Customer Service

The goal of the customer service program is to continue to demonstrate responsiveness and efficiency to retail and wholesale customers and to reduce the time to resolve customer problems and service requests.

4.7.1 Steering Committee & Work Group

This program includes the continuation of the steering committee and work groups with tier-one customers. The goal is to maintain open communication with wholesale and retail customers.

Early Period

Discuss with the First Tier Partnering Steering Committee the findings, conclusions and recommendations of this Master Plan. Develop with the Steering Committee a plan for adopting or seeking approval of the Master Plan by the Board of Water Commissioners and wholesale customers.

Discuss with the Southeast Michigan Consortium for Water Quality the findings, conclusions, and recommendations of this Master Plan. Determine how the Consortium chooses to be involved in commenting on the Master Plan and progress reports on its implementation.

Involve the First Tier Partnering Steering Committee and appropriate work groups in the annual development and reviews of DWSD's CIP, and its coordination with wholesale customer CIPs.

Middle and Late Periods

Continue discussions with customers and stakeholders to make improvements to the program

4.7.2 Customer Liaison

The objective of this program is to provide a single customer liaison for each wholesale customer to ensure that DWSD is responsive to the needs of its customers. Planning discussions now underway at the DWSD include assignment of a liaison by

county served for water or sewer service. The customer liaison program should be extended to neighborhoods in the City.

Early Period

Discuss the program with the First Tier Partnering Steering Committee and make develop an implementation plan with the committee's advice.

Develop an annual process to evaluate and update the Customer Liaison program. Assess results and make improvements as warranted.

Middle and Late Periods

Continue the customer liaison program and update and refine it based on the results of annual surveys.

4.7.3 Compliance and Enforcement

Early Period

Complete the work of the Contracts Work Group by early 2004 and develop a set of new model contract provisions and new contract capacities recommended by this Master Plan, or modified by the Contracts Work Group.

Complete negotiations with all first-tier customers to adopt the new model contract provisions and new contract capacities.

Develop internal procedures to identify and enforce provisions of the recommended model contract when wholesale customers exceed their contract capacities.

Develop an annual process for evaluating and rewarding annually those wholesale customers who meet compliance criteria.

Middle and Late Periods

Continue compliance and enforcement efforts.

4.7.4 Facilities and Service Area Expansion

The objective of this program is to develop a program to evaluate, allocate costs, and establish charges for new facilities requested by customers.

Early Period

In the period 2004 to 2015, the objective of the program is to develop a customer-oriented policy that provides direction to decisions on expansion of the regional service area. Specific recommendations are listed below.

- Develop a procedure for consideration of service area expansion consistent with any "smart growth" policies as may be adopted by the State of Michigan Land Use Task Force.
- Require that communities that consider connecting to the DWSD system to submit a request along with their master plan and zoning plan.
- Review plans in accordance with the criteria and recommendations from the State Task Force's and based on criteria established in the Areawide Water Quality Management Plan (208 Plan)
- Establish a work group within the First-Tier Partnering initiative on service area expansion to make the review and recommendations.
- Continue to implement the "growth pays for growth" strategy for new customers.
- Publish annual guidelines that completely describe the "growth pays for growth" policy.

4.7.5 Public Outreach and Information

Early Period

During the Wastewater Master Plan, the planning team attended several meetings of Detroit neighborhood police precinct meetings as a means of informing and gathering input from retail customers. Evaluate this meeting format for annual briefings to retail customers on DWSD's customer service, wastewater collection and treatment, and operational efficiency efforts.

Develop an annual survey to seek the comments of retail customers regarding DWSD's responsiveness and service within Detroit.

Using the resources of DWSD's public information work group, develop an ongoing program for public outreach and information.

Middle and Late Periods

Continue discussions with retail customers, and annually update the format based on the results of the annual surveys.

4.8 Human Resources and Technology

This program is the continuation of the DWSD's current efforts to improve its human resources program for efficient operation of the regional collection and treatment system, as well as service to the residents of the City of Detroit. The following elements are included:

- Asset Management and GIS
- Energy Management Program
- Emergency Preparedness
- Performance Management and HRIS
- Staff Development and Recruiting
- Labor Management Strategy

4.8.1 Asset Management and GIS

This program includes the establish an asset management tools to meet the requirements of GASB 34 and CMOM regulations, to improve short- and long-term efficiency and effective utilization of capital investment, improve purchasing system, improve internal financial controls and understanding of DWSD's financial requirements.

This program also addresses the need and use of GIS and data management technologies for the DWSD in its ongoing asset management and wastewater master planning activities.

The goals of the asset management and GIS program are:

. Identify improvements to the existing asset management systems to address new accounting requirements and goals of this master plan.Maintain the GIS and data managements environments established to support the wastewater master planning functions.

- Integrate the master planning GIS and data systems into the upcoming DWSD GIS project CS-

1367.

- Maintain current computer hardware and software for the GIS and data management environments to function properly.

- Develop and retain skilled staff to operate and maintain the GIS and data management systems plus the computer hardware required to support them.

Early Period

In the period 2004 to 2015, the objective of this program is to combine existing asset management programs into one system that will fully integrate CMMS (plant and field) with financial system and forecasting tools. The resulting system will provide required information on repair and replacement (R&R) needs and ensure that such information is fully reflected in the DWSD financial and budgetary planning process, including development of the yearly capital improvement program.

Many different computerized management systems are available to accomplish the following critical management tasks:

- **Maintenance Management**: Developed to schedule and record maintenance of equipment. Sometimes tied to GIS and financial accounting system through a work order system.

- **Facilities Management:** Developed to schedule and record maintenance of buildings and other facilities. Sometimes tied to GIS and financial accounting system.

- **Asset Management:** Developed to record all the assets of a utility and document maintenance activities and/or depreciation of assets. Should be tied to financial accounting system and meet the new guidelines of the General Accounting System Board (GASB-34).

- **Project Scheduling and CIP Development**: Compilation of information on capital improvements needed in the utility's system, based on a list of assets and scheduling of maintenance and replacement.

- **Financial Accounting System:** Records expenditures for equipment and consumable purchases, payroll, and other budget categories.

- **Geographic Information Systems (GIS):** Mapping software useful in recording locations of assets in the system, but often tied to a database that can include data on facilities.

- **Permit Tracking:** A record-keeping system of all authorizations to make changes and repairs to the public system.

- **Work Order Tracking System**: A system of entering utility customer service request information on a daily operational basis for planning response strategy, as well as planning the maintenance of assets throughout the year and plotting their useful life.

The following computer systems and programs have been developed, or are in use by DWSD and should be integrated into fewest possible number of systems:

EMPAC: Maintenance management and work order system.

Central Resource Database: Database of buildings and other facilities.

Oracle Assets: Asset management system used for accounting and financial management.

DRMS (Detroit Resource Management System): City purchasing and accounting system based on Oracle software. Accounts payable, accounts receivable, general ledger, and purchasing modules are being used.

VMS: Vehicle maintenance and management system.

Asset Audits and Condition Assessment and Restoration Program (PC-744): Program to develop a maintenance and capital replacement pro-

gram for the Wastewater Treatment Plant.

GIS: A geographic information system is currently scheduled for development. DWSD paper maps are currently digitized and linked to limited system data.

Work Order Tracking System (WOTS): The need for recording customer service information and maintenance response has been identified. This system is currently under development.

Management changes should be fully implemented, and existing programs and software reviewed, before any new software systems are acquired.

Computer software has evolved to the point where several of the above functions can be performed by fewer programs. With the proliferation of such software programs, review and coordination of computer programs is important to accomplish the following goals:

1. Avoid duplication of the same information, often with errors copied from one program to another.

2. Link software to minimize labor involved in rerecording data.

3. Ensure that all personnel are able to use the software and follow through with recording essential information. If information is not entered routinely or correctly, such databases become quickly obsolete.

4. Select software that is easily upgradeable and supported by the companies that supply them, so that programs can be used for a reasonable length of time.

Complete the establishment of the Capital Management Section within DWSD**.** The first mission of this group should be to review all existing maintenance, asset, and financial management programs.

Develop an overlay information system or integrate existing systems so that cost accounting/ general ledger, CMMS, budgeting and budget projection system, and inventory control system are relying on same information are talking to each other. This can be done through the following steps:

- Form an internal committee comprised of representatives of each major division to review all databases and software programs used in the Department, and determine their uses and limitations. The possibility of including outside independent non-vendor expertise on a technical review board should be explored.
- Review software programs for duplication.
- Rank and recommend department-wide software to be used for designated purposes. In particular, software needed to meet regulatory and financial requirements (GASB-34, CMOM, etc.) should be identified as a high priority.
- Negotiate with vendors to ensure that training, upgrades, and technical support are available before purchases are made.
- Identify and collect common asset information for use in all databases.
- Identify individuals in each division responsible for computer software maintenance.
- Require computer software training as a key component of all technical projects.
- Include computer training, aptitude, and maintenance of computer databases as a measurable component of job performance.

Once the integrated system for asset management is developed, then the following procedures should be developed:

- Develop maintenance repair and replace (R&R) schedules based on track history with specific assets.
- Develop and track asset repair histories and de-

velop protocols for tracking and projecting frequency and costs of anticipated repairs.

- Incorporate into budget/rate projections.
- Adjust PM/maintenance protocols based on condition assessments.
- Adjust R&R budgets and remaining useful lives based on condition assessment and historical repair/replacement information. Develop the intelligence in the integrated system, so that full life cycle costs are tracked at asset level and are able to identify the assets that have become cost-effective to replace versus those where continued CM and PM are appropriate.

To maintain the current Master Planning data sets and tools, the DWSD needs to identify and procure the required hardware and software. The activities to be completed in the year 2004 would be:

- Continued maintenance of the MicroStation DGN wastewater section maps. The CS-1367 project will address changes in data development required for the long term.
- Procure and install a Master Plan Server (can also be utilized for the Comprehensive Water Master Plan data sets) that has the RAM and hard drive space to handle the large data sets plus has the Oracle database software running.
- Procure and install a GIS workstation running GeoMedia Professional, the software environment required to maintain the seamless Master Plan data sets.
- Procure and install a workstation designed for GIS mapping running the ArcView software for producing maps.
- Procure and install a large-scale color plotter (E-Size) for map production related to the master plans.

During the same time period, the GIS and computer systems program should also address other topics such as:

- Training
- Capacity Modeling
- Data Deployment

Training -The DWSD needs to establish two levels of training related to the Master Plan - 1) end user training and 2) data set management training.

- **An End User Training** program needs to be established to provide continuous training programs utilizing easy to use application software, like ESRI's ArcExplorer.
- **Data Set Management** training will focus on keeping the data sets - population, flows, sewer network, etc. - up to date so continuous master planning can be accomplished by the Planning Section.
- **Capacity Modeling** - One major work effort from the master planning activities has been the development of sewer capacity models for the entire DWSD interceptor system. This model, housed within the MikeSWMM software environment, will be used by planning staff to maintain the Master Plan analyses. The use of the MikeSWMM software and its integration with the GIS and database systems would be addressed during this early period.
- **Data Deployment** - the last area to be addressed during the early period of recommendations is data deployment. The information developed under the Master Plan should be made available, through simple server access, in a read-only environment for staff throughout the DWSD organization. By deploying Master Plan data sets out to the DWSD staff, acceptance and "buy-in" will begin to happen.

The applications and data sets developed by the Master Plan can be the initial applications for the enterprise wide GIS project (CS-1367).

- The DWSD Planning staff should be integrally involved in the upcoming GIS project (CS-1367). The new GIS project will be creating the standards for several technical topics that will affect the master planning process including:
  - The DWSD service area base map
  - GIS and data management software
  - Computer hardware
  - Sewer data, both spatial and attributes
  - Application definition and integration such as GIS links to Mike SWMM.
- DWSD planning staff must work closely with SEMCOG to receive critical updates on population and employment data.
- DWSD planning should find and hire a GIS technician to support the planning staff in its master planning projects. The GIS and its related data will be an important component of an updated Master Plan in the near future.
- DWSD planning should begin, in concert with the GIS project (CS-1367), to procure required computer hardware (high-end GIS and modeling workstations, plotters, etc.) and the necessary software (GeoMedia, Oracle, ArcGIS, etc.)

Middle and Late Period

In the period 2011 to 2030, the objective of this program is to assess the functionality of the asset management system in light of management needs at that time and the availability and types of technology available to expand and improve the system.

Identify opportunities to move the system towards real-time management through linking SCADA data system with existing elements of the asset management system. Assess, re-evaluate, and modify as appropriate the asset service standards that have been established and embedded in the asset management system.

Given that GIS and computer technologies change every 18 months, by the time the Middle Period time frame (2010 - 2025) is here, the technologies and methodologies being used will be very different. The only recommendation that can be made here is related to technical involvement.

Technical Involvement requires that DWSD staff get actively involved in local, state and regional organizations that address the use of GIS and data technologies in wastewater management and operations. This will allow DWSD to stay on the "leading edge" with respect to the latest GIS, data management and computer hardware.

4.8.2 Energy Management Program

This program addresses the energy management activities within DWSD and sets a goal to reduce energy costs by evaluating / monitoring energy consumption at wastewater treatment and pumping facilities, installing energy conserving equipment and managing power loads.

Early Period

In the period from 2003 to 2010, the DWSD should begin to examine the details of its energy consumption documenting the locations where savings may be achieved. Currently the WWTP requires 721 Kw/Hr per MG, which is comparable to other wastewater facilities.

At the WWTP it is recommended that a Variable Frequency Drive (VFD) drive be considered for Influent Pump Station No. 1. Also, the use of VFD drives should be investigated for at least one of the SFE pumps.

For the wastewater pumping stations it is recommended that at least one of the pumps at the Clintondale and Woodmere pumping stations should be considered for a VFD. Also at pumping stations, every three years, DWSD should evaluate the actual power consumption verses the theoretical power demand for actual flow and head read-

ings.

When purchasing new equipment DWSD should make sure that high efficiency motors are specified.

Middle Period

As can be expected, for the period form 2010 to 2025 energy costs are very likely to escalate sharply. During this period, the DWSD should have in place the mechanisms to track energy consumption and the tools in place to provide for energy form alternative sources. The alternative energy source technologies will become more cost-effective, especially with the expected rising costs of fossil fuels. Therefore, the DWSD should address alternative sources of energy, such as solar power, for remote building lighting.

4.8.3 Emergency Preparedness

The goal of the emergency preparedness program is to incorporate response procedures for emergencies and security into DWSD's operation and maintenance practices.

Early Period

DWSD, like all major utilities, has made recent updates and expanded procedures for emergency preparedness since September 2001. Many of the plans have been developed with a high degree of security, and only limited information was made available to this Master Plan.

DWSD staff engaged in security and emergency response planning should review this Master Plan and annually review the proposed CIP to identified proposed changes to specific facilities.

Middle and Late Periods

Continue emergency preparedness activities.

4.8.4 Performance Management and Human Resources Information System (HRIS)

This program includes the development of human resources tools that will improve individual and group productivity at DWSD. There are two goals of the program. This program also includes the implementation of a human resources information system to develop workforce measures and the ability to track and control human resource actions to enable competitive staffing, development, compensation, and performance system implementation at DWSD.

Recommendations are only presented for the Early Period given the dynamic nature of human resources work.

The City of Detroit Department of Human Resources has responsibility for most human resources initiatives that are the subject of the recommendations below. DWSD and DHR should establish a working committee to meet regularly to formalize and implement the recommendations listed below.

Early Period

The objective of this program is to improve performance and management of performance reviews. The DWSD/DHR working committee should develop a plan to:

- Build depth and breadth of participation in the "Service Improvement" performance review process with unit performance scorecards, strengthened progressive/positive discipline procedures, and processes for recognition and reward and group incentives.
- Improve legal and management support for dealing with substandard performance.
- Strengthen the organization development section of the HR unit internal to DWSD.

4.8.5 Staff Development and Recruitment

This program includes the implementation of an improved approach to training and development. This program also includes the recruitment and hiring of DWSD staff. The objective of this program is to streamline the recruitment process using cost and time effective recruitment/hiring process that serves the competitive needs of DWSD. There are several goals of the staff development program.

- Develop accountability in training group management for achieving measurable goals.
- Train staff in new technologies including information technologies and management styles.
- Establish a development plan for every employee that fits the employees' needs.
- Establish desired performance goals.
- Develop a recruitment process for local universities, technical colleges, community colleges, and technical organizations.

Early Period

The objective of this program is to re-engineer the recruitment-selection business process.

The DWSD/DHR working committee should develop a plan to achieve the following objectives:

- Develop a formal recruitment program for technical staff utilizing local and regional universities and professional organizations.
- Improve training management accountability for developing measurable standards.
- Improve training management accountability for achieving the measures they develop.
- Improve line management accountability for ensuring that employees have reasonable development plans and that they are implementing them.
- Consider elevating the recruitment and staff development function to report directly to the director or an assistant director level position.
- Add a job rotation component to the training vision through the succession planning system recommended below.

4.8.6 Compensation

The goal of this program is to establish wage rates that are adequate to attract qualified personnel, while staying within operating budget targets.

Early Period

The following recommendations are designed to build on the current approach to compensation:

- Use a workforce planning system to plan and identify critical human resources needs. This system can be incorporated or included in the Human Resources Information System (HRIS).
- Expand on and "target" salary surveys to those areas identified as critical for DWSD.
- For critical jobs, develop strategies for competitive salary adjustments.
- Eliminate multiple titles/ranges or "broadband" salary ranges for non-critical positions.
- Consider group incentive goal-sharing plans contingent on specific DWSD performance targets.

4.8.7 Labor Relations

This program includes the development of a productive labor-management relationship that will serve both parties interests for DWSD's future. This will be accomplished though the following recommendations.

Early Period

The objective of the program is to improve labor-management relationships. Establish a labor-management committee to develop a plan to achieve the following objectives:

- Collaboratively create a 10- to 20- year vision of

where DWSD wants labor management relations to go. Contrast Dearborn and Flint UAW models.

- Involve labor in visits to privately operated facilities. Capitalize on the idea that reasonable people confronted early enough with the same information, will come to similar conclusions.

- Create a private management strategy that deals with how management can cultivate (or at least keep from deterring) progressive labor-management leadership within both DWSD labor and DWSD management ranks. Communicate that strategy to key management members.

- Develop a "meet & confer" process to be used between negotiating periods to deal with interim issues and invite the union to confer on traditional management rights issues. The goal is to strengthen labor management relations over the long term, develop progressive labor and management leadership, and facilitate enhanced negotiations.

- Drive the interest-based negotiating model into the heart of both formal negotiations as well as the informal "meet & confer" processes.

- Continuously focus both negotiations and "meet & confer" efforts on 'Broad-banding' to reduce multiple classifications at DWSD.