

# 20-Year Comprehensive Facility Plan

Critical Repair and Reinvestment Plan

Volume 1: Programmatic and Integrating Information



**In Association with:  
NAC | K.S. Ware & Associates | RKX | Powers Engineering**

**June 2017**



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June 30, 2017

Subject: 20-Year Comprehensive Facility Plan—Critical Repair and Reinvestment Plan

Dear Ms. Akridge,

The attached 20-Year Comprehensive Facility Plan, also referred to as the Louisville and Jefferson County Metropolitan Sewer District (MSD) Critical Repair and Reinvestment Plan, represents MSD's most ambitious planning effort in a decade. The 2-year effort reviewed the challenges our community faces now and in the future, identified practical solutions, and developed a roadmap to protect the health, economic vitality, and environment of our city. The recommendations in this Facility Plan are the result of careful evaluation by the Facility Plan Team, which includes some of the most experienced engineers in Louisville Metro. We believe that the recommendations presented in this Facility Plan are essential to maintaining reliable facilities that will allow MSD to fulfill its responsibility for safe, clean waterways and help preserve and promote our competitiveness as a city.

One driver that led to Facility Plan development was a recognition that—for the past 10 years—MSD has focused much of its resources and investments on tackling the federally mandated undertaking to reduce sewer overflows. Major investments in other infrastructure rehabilitation, renewal, and replacement were limited by the community's desire to keep rates at or below industry averages, even as capital and operating spending ramped up to meet Consent Decree requirements. In the face of limited resources, MSD staff still continued its excellent record of regulatory compliance in areas not related to sewer overflow control by focusing on the day-to-day operation and maintenance of wastewater, stormwater, and flood protection facilities.

The result of deferred investment on infrastructure renewal and replacement is that Louisville's aging system of pipes, pumps, treatment plants, and flood control systems is now in urgent need of rehabilitation if it is to continue reliably protecting public health and safety. The Facility Plan recommends taking immediate action to begin implementing critical improvements to the wastewater, stormwater management, and flood protection systems.

Acting in accordance with the recommended schedule of improvements will require a significant investment from the community. Starting on these critical projects while still only halfway through the Consent Decree response will require a step-change increase in wastewater and drainage rates. If the community is unwilling to accept the rate increases necessary to fund the project schedules recommended, then many important projects will need to be deferred until the major Consent Decree spending is complete. The data indicate that *not* implementing necessary investments in a timely manner is almost certain to result in more infrastructure failures, an increase in the overall Facility Plan implementation cost, and an ever more rapidly increasing likelihood of a failure that could have serious consequences for the residents and business that make Louisville Metro their home.

Following the release of the December 2016 draft of the Facility Plan, MSD undertook a wide-reaching public outreach initiative, aimed at bringing many perspectives to the table for constructive dialogue about the needs and timing of implementing the Facility Plan recommendations. Community input confirms that Louisville supports restoring its vital wastewater, flood protection, and stormwater management facilities. Following are responses from those who engaged in the community conversation:

- Ninety percent of respondents understand and agree with the need for investing in the community's wastewater, stormwater, and flood protection systems to reduce risks to public health and safety rather than continuing to defer critical repairs and reinvestment.
- Eighty-nine percent of respondents believe beginning to address the public health and safety risks as quickly as possible is important.
- Seventy-one percent of respondents support increasing residential rates of up to \$10 per month (with a proportional increase in industrial and commercial rates) to immediately begin funding critical wastewater, stormwater, and flood protection needs that address public health and safety risks.
- Seventy-eight percent of respondents support expanding MSD's existing Rate Relief Program to assist customers who meet federal criteria established for other utility rate assistance programs.

Working with MSD on this important planning assignment that addresses critical infrastructure issues impacting the future quality of life in our community has been an honor and privilege for the entire Facility Plan Team. The undersigned leaders of the Facility Plan Team, as representatives of our respective firms, proudly submit this final Facility Plan for your consideration.

Respectfully Submitted,

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## 20-YEAR COMPREHENSIVE FACILITY PLAN – PLAN OVERVIEW

### PURPOSE

In January 2014, the Louisville and Jefferson County Metropolitan Sewer District (MSD) Board adopted a new Strategic Business Plan that defined a change agenda for MSD. The intent of the Strategic Business Plan is to dramatically improve customer care and service; make appropriate investments in technology, infrastructure, and employees; and improve the quality of life in Louisville and Jefferson County, while maintaining the financial viability of the utility. A key part of MSD’s plan to implement the Strategic Business Plan is to develop this 20-Year Comprehensive Facility Plan—Critical Repair and Reinvestment Plan (Facility Plan). The purpose of this Facility Plan is to accomplish the following:

- Consolidate MSD’s planning and prioritization for facility rehabilitation, renewal, replacement, upgrade, and expansion across all its service areas.
- Recommend and prioritize projects and programs to achieve the following objectives:
  - Protect the public health and safety of the community.
  - Protect our aquatic and terrestrial environment.
  - Meet customer expectations for a consistent level of service.
  - Comply with all federal and state laws, regulations, orders, and standards.

This Plan Overview presents a high-level summary of the Facility Plan and discusses the compelling need for implementing the recommendations presented herein.

### BACKGROUND

From 1985 to 2003, MSD spent close to \$1 billion on improvements to the wastewater collection and treatment system to address high-priority public health and safety issues. During this same period, a \$134 million program for managing intermittent wet-weather sewer overflows was also underway to study the system behavior and subsequently design and construct several important sewer overflow abatement facilities. However, the investment made to tackle sewer overflows was not deemed sufficient to meet water quality goals within timeframes established by federal and state regulators, and in 2003, MSD received a request for information from the U.S. Environmental Protection Agency (EPA) in accordance with Section 308 of the Clean Water Act. This request for information was the first step in a process that eventually led to a notice of alleged Clean Water Act violations from EPA and the Kentucky Department for Environmental Protection (KDEP); this notice resulted in a negotiated settlement between these parties most commonly referred to as the Consent Decree.<sup>1</sup> One requirement of the

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<sup>1</sup> The Commonwealth of Kentucky, Plaintiff, and the United States of American, Plaintiff-Intervener, v. Louisville and Jefferson County Metropolitan Sewer District, Defendant, in the United States District Court, Western District of Kentucky, Louisville Division. Amended Consent Decree, Case 3-08-cv-00608-CRS. Filed April 15, 2009. Available at <http://www.msdpjprojectwin.org/Portals/0/Library/Consent%20Decree/Agreement/Commonwealth%20of%20KY%20vs%20MSD%20%20Amended%20Consent%20Decree.pdf>.

Consent Decree was for MSD to develop overflow abatement plans to address combined sewer overflows (CSOs), separate sewer overflows (SSOs), and unauthorized discharges. In response to this requirement, MSD consolidated the required overflow abatement plans into the Integrated Overflow Abatement Plan (IOAP), a long-term plan to control CSOs and eliminate SSOs and other unauthorized discharges in MSD's sewer system. Submitted December 2008 and approved by regulatory agencies in August, 2009, the IOAP identified \$850 million in capital improvements, associated incremental operating costs, and a high-level financial plan that included cash-flow projections, projected borrowing schedules, and projected rate increases through the year 2024.

With the filing of the enforcement action, sewer overflows became the top priority, and MSD shifted resources and investments agency-wide to tackle this massive federally mandated undertaking. Spending in areas other than sewer overflow control was focused on the day-to-day operation and upkeep of wastewater, stormwater, and flood protection facilities. Major investments in infrastructure rehabilitation, renewal, and replacement were limited by a desire to keep rates at or below industry averages, even as capital and operating spending ramped up to meet the Consent Decree requirements. This shift was especially significant given that portions of the stormwater and flood protection system were already in decline due to exceeding their expected design life prior to MSD assuming responsibility for these facilities in 1987; and the initial funding source that had been established to address this deferred renewal and replacement was insufficient to address all the improvement needs identified.

The result of this deferred investment over the past 10 to 15 years is that Louisville's aging system of pipes, pumps, treatment plants, and flood gates are now in urgent need of rehabilitation so they can continue to reliably protect public health and community safety. While iconic landmarks and prominent structures garner more attention, Louisville is also home to a less visible system of facilities that serve a higher calling behind the scenes every day—facilities that keep Ohio River floodwaters at bay, prevent harmful bacteria from entering homes and local waterways through sewer overflows, and reduce the likelihood of disease outbreaks such as Zika virus spawned by poor drainage. When pipes fail and structures in the system collapse into sinkholes, and when inland flooding blocks roadways, access to emergency services and critical care is denied. A properly functioning sanitary sewer, stormwater, and drainage system is needed to support the community's economic engine, protect jobs, and sustain the local tax base.

Neglecting this essential system is no longer an option—serious failures are occurring at an increasingly rapid pace. The ability to successfully apply temporary repairs rather than permanent fixes diminishes significantly with each passing day. Rainfall totals that once could be managed by the system now overwhelm it. This risk is heightened by the increased frequency of extreme storm events. The back-to-back storm events experienced in 2015 flooded homes, leaving families without shelter. Cars were washed away, streets were impassable, schools and businesses shut down, and public safety was threatened in proportions not seen in decades. Citizens demanded that measures be taken to prevent similar occurrences from happening again.

Despite the public call to action, MSD recognized that there would likely be concern about the costs to complete the Consent Decree IOAP projects and meet the public expectation of improved levels of service provided by the wastewater and stormwater services. To help identify appropriate levels of investment and priorities, MSD developed this 20-year Comprehensive Facility Plan that consolidates

MSD's planning for facility rehabilitation, renewal, replacement, upgrade, and expansion across all its service areas. Projects listed in the Facility Plan were determined by the Facility Plan Team to address critical needs requiring correction over the next 20 years to protect the community health and safety, provide environmental protection, meet customer expectations for level of service, and move closer to the goal of our local waterways achieving federal and state water quality standards. This Facility Plan will also consider the long-term operating needs to accommodate operation and maintenance (O&M) of new facilities coming on line under the IOAP and other critical infrastructure investments.

Maintaining consistency in levels of service and protecting ratepayers across the entire Louisville community are also key objectives of this Facility Plan. The aim is to provide protection from drainage problems to a consistent 10-percent probability storm (also commonly referred to as a 10-year storm). Currently, the most recently constructed areas in the community are designed to protect against drainage problems due to the 10-percent probability storm as defined by MSD's current Design Manual (a 4.5-inch rainstorm occurring in 24 hours; MSD, 2015). Many older neighborhoods in the service area, constructed before MSD assumed responsibility for stormwater management, begin to experience localized drainage problems in a 3-inch rainstorm occurring in 24 hours. The implication is that MSD's current level of protection is not consistent across the service area.

Based on the analyses of this 20-Year Comprehensive Facility Plan, meeting the critical needs of the community is estimated to cost \$4.3 billion over the next two decades. The reality is that the original Consent Decree resulted in large part from a similar pattern of deferred rehabilitation and reinvestment in critical wastewater infrastructure. The Facility Plan Team believes the community should not risk burdening our children and grandchildren with future federal mandates because of an unwillingness to dedicate adequate resources to the challenges of today.

MSD strongly believes that the Louisville community deserves to be informed on matters of public health and safety, and likewise, should have a voice in the conversation about the timing of necessary infrastructure investments. MSD committed to facilitating discussions with customers, business leaders, elected officials, and others. With this overall goal, after the draft report was submitted in December 2016, MSD undertook the wide-reaching "Community Conversation" initiative described in Volume 1 Section 2, aimed at bringing many perspectives to a constructive dialogue. This dialogue did not center around *if* the risks to the public health and safety of families and business owners will be addressed, but rather *how soon should the work begin*.

Community input confirms that Louisville supports restoring its vital wastewater, flood protection, and stormwater management facilities. Responses from those who engaged in the community conversation are as follows:

- Ninety percent of the respondents understand and agree with the need for investing in the community's wastewater, stormwater and flood protection systems to reduce risks to public health and safety rather than continuing to defer critical repairs and reinvestment.
- Eight-nine percent of the respondents believe it is important to begin addressing the public health and safety risks as quickly as possible.
- Seventy-one percent of the respondents support an increase in residential rates of up to \$10 per month (with a proportional increase in industrial and commercial rates), to immediately begin to

fund critical wastewater, stormwater, and flood protection needs to address public health and safety risks.

- Seventy eight percent of the respondents support expanding MSD’s Rate Relief Program, to assist customers who meet federal criteria established for other utility rate assistance programs.

This input echoes the priorities identified by local citizens at the 100 Resilient Cities Workshop hosted by Louisville Metro in early 2017, including the risks of severe or catastrophic weather, infrastructure vulnerability, and aging infrastructure.

### **SCOPE OF PLAN**

As noted previously, the following are the purposes of this Facility Plan:

- Consolidate MSD’s planning and prioritization for facility rehabilitation, renewal, replacement, upgrade, and expansion across all its service areas.
- Recommend and prioritize projects and programs to achieve the following objectives:
  - Protect the public health and safety of the community.
  - Protect our aquatic and terrestrial environment.
  - Meet customer expectations for a consistent level of service.
  - Comply with all federal and state laws, regulations, orders and standards.

This Facility Plan has identified overall financial needs for future facility rehabilitation, renewal, replacement, upgrade, and expansion. The projects are those recommended by the Facility Plan Team as needed to achieve MSD’s mission, vision, and goals. All projects have been assigned recommended schedule dates and durations based on the Facility Plan Team’s assessment of their relative priority and needs. The project schedules will be further refined by MSD staff as part of the annual budgeting process. In addition, this Facility Plan, like all long-term plans, should be revisited on a recommended 5-year cycle to make adjustments as changing conditions develop.

For projects directly affected by precipitation events, the Facility Plan includes projected rainfall intensity, duration, and frequency (IDF) curves for year 2035. These projections consider both statistical trends going back 60 years, along with state-of-the art global circulation models that project future precipitation conditions. These models reflect the observed increased frequency of extreme storm events that we have experienced, presumably related to the impacts of global climate change.

This Facility Plan recommends that MSD’s current design criteria for facilities (based on published storm recurrence intervals) will apply to new facilities planned as appropriate, with revised precipitation projections applied to the recurrence intervals in the criteria. For example, stormwater culverts under secondary roadways will continue to be designed to the 10-percent probability storm (commonly known as the 10-year storm), but the 24-hour rainfall value used in the calculations reflects precipitation projections for the end of the 20-year planning period (2035). The Facility Plan recommends that MSD’s design standards be modified to incorporate the projected 2035 precipitation projections in the requirements for new construction. For example, the 10-percent probability storm projected for 2035 is



5.2 inches of rain occurring in 24 hours, as compared with the current MSD Design Manual value (2015) of 4.5 inches of rain occurring in 24 hours.

This Facility Plan considers the operating costs, including staff increases, to accommodate O&M of new facilities coming online under the IOAP and this Facility Plan. In addition, shortfalls in current O&M budgets and staffing levels for facility maintenance have been evaluated, and a program to adjust both budgets and staffing over time has been recommended. The recommended budgets and staffing levels are intended to allow predictive and preventive maintenance to occur in accordance with current industry best practices for asset management.

A key part of the Facility Plan is a recommended 20-year capital improvement program (CIP). Projects in the recommended 20-year CIP were determined by the Facility Plan Team to address critical needs requiring correction over the next 20 years. Another key objective of the Facility Plan is consistent service for ratepayers across the entire Louisville community. The aim is to provide wastewater, drainage, and flood protection services to a 10-percent probability storm (10-year storm) for all customers within the MSD service area by the end of the 20-year planning period.

## **PROJECT DEVELOPMENT**

The Facility Plan Team identified projects through a number of pathways. MSD's current CIP contains more than 100 projects related to wastewater systems. If these projects were already in design or construction, then these existing projects were included in the recommended 20-year CIP without change. If the projects were not in design or construction, then project needs were identified, project justification reviewed, and costs verified. These projects were then subject to prioritization along with all the other projects.

The IOAP has a number of very large projects still to construct. These projects are required to be completed on the schedule presented in the approved IOAP. No changes were made to the IOAP projects or their schedules.

MSD has a number of existing planning studies related to wastewater that have not been fully implemented, primarily because of funding limitations. The Facility Plan Team evaluated existing studies and found a number of worthwhile projects that have not been included in the CIP yet. These projects were evaluated and are included in the project mix for prioritization.

Finally, the Facility Plan Team looked for gaps in previous planning. This included reviewing population projections, assessing regulatory changes that might occur during the 20-year planning period, and conducting a facility condition assessment that included staff interviews, visual inspections, and in some cases diagnostic measurements. The projects resulting from regulatory changes will be mandatory to complete in the timeframe dictated by the adoption of new regulations. The anticipated timeframes for new regulations and new regulatory enforcement priorities have been identified by the Facility Plan Team, understanding that regulatory issues are not totally predictable and not within MSD's complete control. The facility condition assessment identified a number of projects that were critically needed to correct the past under-investment in asset renewal and replacement. A review of maintenance trends confirmed that the number of infrastructure failures (for example, sewer collapse, pump station capacity shortfalls) is directly related to the asset's age. This implies a system-wide deficiency in

effective preventive maintenance, which impacts both the reliability and the overall cost of ownership of those assets.

## **PROJECT EVALUATION AND PRIORITIZATION**

Project evaluation and prioritization requires a rigorous and transparent approach. The approach used to develop the IOAP was very successful in this regard and, to the extent possible, was replicated in developing this Facility Plan.

Given the variety of ways that projects were identified and developed, capital and operating cost-estimating used a variety of sources. The IOAP Cost Tool was used to develop project costs where applicable (new projects with standard components like sewers and pump stations). Where the standard cost tool could not be applied, the team used industry-standard cost references such as RS Means. When similar MSD projects were available, the estimating was conducted using unit prices from those projects.

Prioritizing projects followed the values-based benefit/cost evaluation used successfully in the development of the IOAP. The Wet Weather Team (WWT) Stakeholder Group was rechartered to continue to assist with IOAP implementation and also to serve a role in helping guide Facility Plan development. Many original members chose to continue serving on this team. Recognizing the broader scope of the Facility Plan, a number of new members representing different interest groups and demographics were added to the WWT Stakeholder Group.

A values-based benefit/cost evaluation assisted with developing scoring scales to grade projects on their effectiveness at protecting the community in the following values:

- Environmental Protection
- Public Health Protection
- Regulatory Compliance
- Sustainability
- Property Protection
- Economic Vitality

The values-based benefit scores were coupled with life-cycle cost information to develop a benefit/cost score used for the first round of project prioritization. This approach was then supplemented with an evaluation of the effectiveness of the project in mitigating risk. Risk mitigation effectiveness was valued based on the change in either the probability of an event happening or the consequence of that event occurring. As Figure 1 indicates, the combination of a high probability and a serious consequence result in a risk that is considered to be “critical.” The anticipated change in risk resulting from implementing a project resulted in a risk reduction factor that was used in conjunction with the benefit/cost score to prioritize projects.



<b>Consequence</b>	5	Critical	Critical	Critical	High	Medium
	4	Critical	Critical	High	Medium	Low
	3	Critical	High	Medium	Low	Low
	2	High	Medium	Low	Low	Very Low
	1	Medium	Low	Low	Very Low	Very Low
		5	4	3	2	1
<b>Probability</b>						

**Figure 1. Risk Evaluation Matrix**

**RECOMMENDED 20-YEAR CAPITAL IMPROVEMENT PROGRAM**

Table 1 summarizes the recommended 20-year CIP, broken down by service area and major program. Note that the values in the table have been escalated at 3 percent per year compounded to the projected mid-point of construction.

**Table 1. Recommended 20-Year Capital Improvement Plan Summary**

Service Area and Program	Capital Cost (in escalated dollars, millions)				Total FY17 through FY36
	FY17 through FY21	FY22 through FY26	FY27 through FY31	FY32 through FY36	
<b>Wastewater</b>	<b>\$848.0</b>	<b>\$392.3</b>	<b>\$353.7</b>	<b>\$262.6</b>	<b>\$1,856.5</b>
Consent Decree (IOAP)	\$564.6	\$26.5	\$0.4	\$0.0	\$591.5
NMC	\$116.2	\$33.2	\$35.1	\$40.0	\$224.5
CMOM	\$144.2	\$275.7	\$184.4	\$201.1	\$805.4
Development	\$23.0	\$56.9	\$133.8	\$21.5	\$235.2
<b>Stormwater</b>	<b>\$348.8</b>	<b>\$623.7</b>	<b>\$636.2</b>	<b>\$734.7</b>	<b>\$2,343.4</b>
Drainage	\$189.8	\$403.0	\$394.0	\$529.7	\$1,516.5
Floodplain Management	\$19.8	\$25.4	\$29.4	\$34.1	\$108.6
Ohio River Flood Protection	\$128.1	\$175.6	\$191.2	\$145.9	\$640.9
Stormwater Quality (MS4)	\$11.2	\$19.8	\$21.5	\$25.0	\$77.5
<b>Support Systems</b>	<b>\$43.5</b>	<b>\$28.7</b>	<b>\$24.9</b>	<b>\$27.4</b>	<b>\$124.5</b>
Capital Equipment	\$11.3	\$14.7	\$16.7	\$19.0	\$61.8
Facilities	\$27.7	\$8.3	\$3.2	\$2.7	\$41.9
IT	\$3.1	\$3.8	\$3.1	\$3.6	\$13.6
LOJIC	\$1.4	\$1.9	\$1.8	\$2.1	\$7.3
<b>Total Escalated Costs</b>	<b>\$1,240.4</b>	<b>\$1,044.7</b>	<b>\$1,014.7</b>	<b>\$1,024.7</b>	<b>\$4,324.5</b>

- FY      fiscal year
- IOAP    Integrated Overflow Abatement Plan
- IT      information technology
- LOJIC   Louisville and Jefferson County Information Consortium
- MS4    Municipal Separate Storm Sewer System



Table 2 summarizes the first 5 years of the recommended 20-year CIP, broken down by year, service area and major program. Note that the values in the table have been escalated at 3 percent per year compounded to the projected midpoint of construction. MSD’s Fiscal Year (FY) 2017 approved CIP did not fully fund the Facility Plan recommendations for that fiscal year due to revenue limitations caused by a cap on the rate increases that the MSD Board can approve without receiving approval from Louisville Metro Council. MSD staff prioritized CIP spending based on the funding available, resulting from the FY2017 CIP budget that was approved by the MSD Board. The net effect is that the projects not funded in accordance with the Facility Plan recommendations will need to be reconsidered at a later date, and when sufficient funding becomes available.

**Table 2. Recommended 5-Year CIP Summary**

Service Area and Program	Capital Cost (in escalated dollars, millions)					Total FY2017 through FY2021
	FY2017	FY2018	FY2019	FY2020	FY2021	
<b>Wastewater</b>	<b>\$150.8</b>	<b>\$188.1</b>	<b>\$210.0</b>	<b>\$161.1</b>	<b>\$138.0</b>	<b>\$848.0</b>
Consent Decree (IOAP)	\$109.9	\$139.5	\$154.4	\$89.7	\$71.1	\$564.6
NMC	\$19.7	\$21.3	\$25.9	\$26.7	\$22.6	\$116.2
CMOM	\$18.6	\$25.1	\$24.1	\$35.7	\$40.7	\$144.2
Development	\$2.6	\$2.2	\$5.6	\$9.0	\$3.6	\$23.0
<b>Stormwater</b>	<b>\$19.1</b>	<b>\$40.8</b>	<b>\$63.7</b>	<b>\$93.0</b>	<b>\$132.3</b>	<b>\$348.8</b>
Drainage	\$4.2	\$16.2	\$31.8	\$59.7	\$77.9	\$189.8
Floodplain Management	\$1.6	\$4.6	\$4.4	\$4.5	\$4.6	\$19.8
Ohio River Flood Protection	\$11.4	\$18.3	\$25.6	\$26.8	\$46.0	\$128.1
Stormwater Quality (MS4)	\$1.9	\$1.7	\$1.9	\$1.9	\$3.7	\$11.2
<b>Support Systems</b>	<b>\$12.5</b>	<b>\$5.5</b>	<b>\$7.0</b>	<b>\$7.4</b>	<b>\$11.2</b>	<b>\$43.5</b>
Capital Equipment	\$ .6	\$1.4	\$1.9	\$2.4	\$5.0	\$11.3
Facilities	\$10.2	\$3.1	\$4.7	\$4.2	\$5.7	\$27.7
IT	\$1.6	\$ .7	\$ .3	\$ .3	\$ .3	\$3.1
LOJIC	\$ .1	\$ .4	\$ .1	\$ .5	\$ .3	\$1.4
<b>Total Escalated Costs</b>	<b>\$182.4</b>	<b>\$234.5</b>	<b>\$280.7</b>	<b>\$261.4</b>	<b>\$281.5</b>	<b>\$1,240.4</b>

**SIGNIFICANT SERVICE AREA PROJECTS AND PROGRAMS**

The following sections will address each of the MSD service areas, along with support services, describing specific assumptions that drove project development.



## WASTEWATER COLLECTION AND TREATMENT

For the past 10 years much of MSD's focus has been ensuring compliance with the Consent Decree requirements. Due to limited resources and a desire to maintain sewer and drainage rates at or below the national average, developing and implementing the IOAP has taken the focus off infrastructure renewal and repair for facilities not related to sewer overflow control. In addition, the weak economy from 2008 to 2012 also reduced the pressure to provide new wastewater service to developing areas. While IOAP implementation is only half finished, the consequences of deferred rehabilitation and reinvestment are beginning to show in increased numbers of sewer collapses, including multiple problems with the Broadway Interceptor and its connecting lines. With the local economy strengthening, MSD is seeing much more interest from the development community to provide sewer service to growth areas across the county. This Facility Plan addresses all these issues, as described in the following sections.

## CONSENT DECREE AND INTEGRATED OVERFLOW ABATEMENT PLAN

The IOAP is a major part of MSD's Consent Decree compliance program. The IOAP is a long-term plan to control CSOs and eliminate SSOs and other unauthorized discharges from MSD's sewerage system. The IOAP is expected to improve water quality in both Beargrass Creek and the Ohio River through and downstream of Jefferson County. The expected water quality benefits of the IOAP include reductions in the peak levels of bacteria in the Ohio River and Beargrass Creek and in the amount of time that average bacteria levels exceed water quality standards. In addition, the IOAP program will enhance public health and safety by reducing the potential for the public to come in contact with untreated SSOs, in the basements of their homes or in the streets and ground surfaces where SSOs currently discharge.

### **Long-Term Control Plan Benefits**

The suite of projects selected for the Final CSO Long-Term Control Plan (LTCP) part of the IOAP will result in approximately 98 percent capture and treatment of wet-weather combined sewage during an average year. This benefit represents an 89 percent reduction in CSO volume compared with conditions in 2008. As a point of reference, the presumptive approach for compliance with water quality standards in EPA's CSO Control Policy (EPA, 1994) is based on a minimum of 85 percent capture and treatment of wet-weather combined sewage.

### **Sanitary Sewer Discharge Plan Benefits**

The suite of projects selected for the Final Sanitary Sewer Discharge Plan (SSDP) part of the IOAP will eliminate capacity-related SSOs up to the site-specific level of protection. The SSO projects are anticipated to eliminate an average of 145 SSO events per year (290 million gallons [MG] of overflow volume), based on 2005 to 2007 data normalized for rainfall. In terms of water quality, SSO projects will eliminate 100 tons of 5-day biochemical oxygen demand (BOD<sub>5</sub>) and approximately 200 tons of total suspended solids (TSS) annually.



## **Sustainable Performance**

MSD's IOAP is based on a "demonstration approach" to achieving compliance with the Consent Decree and the Clean Water Act requirements. While MSD is required to certify compliance with the CSO management requirements after completing the full suite of CSO projects in 2020, MSD's CSO management performance will continue to be monitored through the Morris Forman Water Quality Treatment Center (WQTC) Kentucky Pollutant Discharge Elimination System (KPDES) permit with performance standards consistent with the commitments of the IOAP. Similarly, the SSO elimination projects are required to be completed by the end of 2024. MSD's certification that the performance objectives have been met will mean that MSD's obligations under the Consent Decree have been discharged, but the requirements for continued operation of collection and treatment facilities in the system to avoid further SSOs will continue through the KPDES permits. The Consent Decree requirements do not go away with the completion of the IOAP projects—the enforcement mechanism for sewer overflow and control changes from the Consent Decree to the respective KPDES permits.

## **Integrated Overflow Abatement Plan Impacts on the Recommended Capital Improvement Program**

Over the first 5 to 9 years of the planning period, the wastewater service area CIP is dominated by completing the remaining major IOAP projects. The major CSO storage basins are all scheduled to be completed by the end of FY2021, with the remainder of the SSO elimination projects scheduled to be completed by the end of FY2025. Completing the entire suite of CSO and SSO projects in accordance with the IOAP schedule is required by the Consent Decree. Any failure to complete a project on schedule could be considered a violation of the Consent Decree, with consequences including stipulated penalties that could total more than \$1 million for a 1-year delay in completion.

The next section of the Plan Overview addresses the balance of the CIP. These projects address needs in wastewater, stormwater, flood protection and asset management infrastructure that have been deferred for the past 10 to 15 years as MSD's limited resources were focused on meeting Consent Decree requirements.

## **NINE MINIMUM CONTROLS**

The EPA Nine Minimum Controls (NMC) were initially developed as part of the Clean Water Act CSO Policy to address combined sewer system (CSS) best management practices (BMPs) that do not require significant construction. In a continued focus on protection of public health and safety, the BMPs required by the NMCs will be integrated into MSD's KPDES permits to ensure protection of public health, safety, and the environment. Maximizing storage in the conveyance system, maintaining WQTC capacity, and ensuring effective public notification of sewer overflows are examples of the BMPs that will remain in place in perpetuity as conditions of the Morris Forman WQTC KPDES permit.

The recommended 20-year CIP includes funding for the formal NMC program that is reported quarterly as part of the Consent Decree requirements. Capital projects that help to sustain the intent of the NMC requirements are included in the preliminary CIP through the end of the planning period.



The most significant long-term NMC activities are the real-time control (RTC) system in the CSS and the Morris Forman WQTC improvements, which are also a major component of the IOAP. The 20-year CIP recommendation provides annual funding for ongoing RTC rehabilitation and renewal to ensure proper RTC system operation system. By using the storage capacity of MSD's large-diameter CSS, MSD can cost-effectively mitigate sewer overflows during smaller storms of concern in CSO control. The cost of providing storage in the pipes is typically a small fraction of the cost to provide that same storage in a stand-alone tank. The long-term operation of an effective RTC system is one of the cornerstones of the IOAP, which is necessary for long-term sustained compliance with the Clean Water Act CSO Policy, CSO Long-Term Control Plan, and NMC requirements.

Sustaining reliable treatment capability and capacity at the Morris Forman WQTC is critical to ensure proper wastewater treatment for Ohio River water quality protection. This treatment is a significant endeavor that has been underfunded since the most recent overall plant rehabilitation was completed in the early 2000s. A detailed facility condition assessment has been prepared for the Morris Forman WQTC liquid process treatment facilities. Periodic equipment replacements and major plant renovations are scheduled in 5-year intervals for financial planning. Overall, the proposed 20-year CIP recommendations include almost \$200 million in rehabilitation and renewal projects over the planning period. To protect public health, these rehabilitation and renewal projects are essential to maintaining reliable operation of the largest WQTC in MSD's system. Unfortunately, the 2015 failure of the Morris Forman WQTC high-voltage electrical distribution center provided a catastrophic view of the consequences of deferring facility renewal and replacement. As power was lost to the main electrical system for the WQTC, inadequate backup power resulted in flooding and extensive damage to the facility. Wastewater was discharged that had not been treated to the State of Kentucky's KPDES discharge standards, creating a potential public health risk to the community. Ironically, the capital project to provide backup power supply for the WQTC had been deferred and, therefore, was not in place to avoid the costly damage to the facility.

This Facility Plan assumes there will be no major changes in the Morris Forman WQTC discharge requirements during the planning period, and therefore, the existing plant will continue to operate as-is for the duration of the planning period, except for initial construction of facilities required for nutrient removal late in the planning period, described herein.

For many years, MSD has produced a high-quality soil conditioner called Louisville Green from the biosolids generated by the WQTC. The condition of the Louisville Green production equipment (primarily the biosolids dryers and pellet processing equipment) is rapidly degrading due to the severe duty conditions experienced in processing the highly abrasive dried biosolids product. MSD has, in the past, been able to sell all Louisville Green it could produce, thereby offsetting system operating costs. The current degraded condition of the equipment requires MSD to landfill dewatered biosolids when the drying system capacity is overwhelmed. MSD, under a separate initiative, is investigating short-term biosolids management solutions that may include increasing the amount of dewatered biosolids disposed of by landfill (by negotiating better prices in return for the commitment of guaranteed minimum amounts of dewatered biosolids being sent to the landfill), turning over management of the dewatered biosolids to a third-party vendor and/or replacing the drying system with an alternate technology approach. Recognizing that implementing a new biosolids management approach may take several years to implement, the recommended 20-year CIP includes short-term fixes for the dryer

system, as well as expansion of the dewatered cake-handling system to allow increased landfilling as continued operation of the dryers becomes impractical. Other approaches to biosolids handling are currently under consideration, because a short-term solution may include designing and constructing a biosolids handling system by a third-party vendor, similar to how the high-purity oxygen generation system is currently being procured. If this procurement model is followed, then MSD will not directly incur capital cost, and the project will have more impact on the annual operating budget than the CIP.

A 50-year look at continued operations of the Morris Forman WQTC at the current site has concluded that there will not be any major changes in discharge standards, including adding nutrient removal or considering microconstituents such as residual antibiotics, hormones, or other pharmaceuticals and residual personal care products, within the current 20-year planning horizon. If major discharge standards changes occur, then they will likely require changes to both the liquid treatment and biosolids-handling approaches. Given the severe constraints of the existing site, locating new facilities on property not part of the current Morris Forman WQTC site will be necessary. The long-term plan has been developed, and a phasing roadmap for systematic facilities expansion is included. Some level of nutrient removal may be required toward the end of the 20-year planning period. The proposed 20-year CIP recommendation includes funds for purchasing land and starting facility construction to address nutrient removal during years 15 to 20 of the planning period. Treatment for microconstituents is not envisioned in the recommended 20-year CIP, but it will represent a significant capital expense when required by new regulations. If and when the discharge requirements change to include advanced nutrient removal and increased removal of BOD<sub>5</sub> and TSS from wet-weather flow, then the costs to expand and upgrade the Morris Forman WQTC could exceed \$1.2 billion (2016 dollars).

#### CAPACITY, MANAGEMENT, OPERATIONS, AND MAINTENANCE

The next largest program within the wastewater service area is the Capacity, Management, Operations, and Maintenance (CMOM) program. EPA Region 4 developed the initial program that became CMOM, and MSD's Consent Decree specifically requires developing and implementing a CMOM program. The intent of the CMOM program is to ensure that BMPs are implemented across all aspects of the utility, thereby increasing the ability of the utility to meet its obligations under the Clean Water Act. CMOM activities represent BMPs for wastewater utilities and will be sustained for the entire 20-year planning period.

Major components of the CMOM program include projects for major renewal and replacement projects at the Hite Creek, Floyds Fork, Cedar Creek, and Derek R. Guthrie WQTCs. These renewal and replacement projects are scheduled at 5-year intervals for each center to ensure that MSD can maintain efficient and effective wastewater treatment, a critical aspect of public health protection. The budget established for each center is the result of an asset inventory and facility condition assessment of each WQTC. The actual scope of each project will be established during detailed design.

The CMOM program provides proactive asset management of pipes and pump stations that make up most of MSD's collection system. Clearwater intrusion of surface water and groundwater during rain events overloads the conveyance and treatment systems. This clearwater intrusion, referred to as infiltration and inflow (I/I), is a main cause of sewer overflows. Budgets are recommended to provide inventory of critical parts for pump stations, rehabilitate and replace sewers that are leaking or in



danger of structural failure, and provide stand-by generators in more locations to improve reliability during power outages. Studies suggest that approximately 50 percent of the I/I entering MSD's sewer system during a rain event may be coming from private property sources outside of MSD's direct control. To achieve and sustain the required overflow abatement levels, a substantial portion of this I/I must be removed from the system. A project with "seed money" to initiate a private property I/I reduction program is also recommended in the CMOM budget. The private property I/I program is expected to become self-sustaining through new fees after initial start-up.

A significant addition to the CMOM program is the recommended expansion of the sewer rehabilitation and replacement activities to encompass major interceptors. In the past, MSD deferred major rehabilitation of these major interceptors due to the cost and difficulty in completing construction on these pipes. An increasing frequency of major interceptor failures indicates a critical need to proactively inspect and rehabilitate or replace these high-risk very old assets. When a major interceptor fails, a ripple effect is created across a much broader area due to road closures, traffic impacts, and other factors that directly impact the community. Since major interceptor rehabilitation projects have not been specifically identified at this time, an allowance has been recommended to begin the process of inspection, project development and early-action remediation of high-risk defects over the next five years. By the end of five years, the recommended allowance is increased to \$10 million per year, totally focused on major interceptor rehabilitation and replacement. At this sustained funding level, MSD will be able to renew these critical assets on a prioritized basis. Preemptive rehabilitation is much less expensive than making emergency repairs, such as those MSD had to complete in response to a collapsed section of the Broadway Interceptor in 2015. This one repair interrupted businesses, severely impacted traffic flow on a main arterial roadway, and impeded access to a nearby hospital.

#### DEVELOPMENT

To assist in providing the proper level of sewer service for growing areas, the recommended 20-year CIP budget also includes treatment capacity expansions for the Hite Creek, Floyds Fork, and Cedar Creek WQTCs. The timing of these expansion projects has been based on population projections for each service area. Ensuring that capacity is available in advance of development supports growth and development for the community by avoiding moratoriums due to the rated capacity of the WQTCs being exceeded. This expansion is in accordance with KDEP regulations. The Derek R. Guthrie and Morris Forman WQTCs are not anticipated to need a growth-related capacity expansion within the 20-year planning period, however, they will require investment to continue operating properly.

In addition to WQTC capacity, the recommended 20-year CIP also addresses conveyance system capacity needs. Projects are recommended to address areas anticipated to have significant growth in the Floyds Fork WQTC and Cedar Creek WQTC service areas due in part to the development of the Parklands of Floyds Fork. Growth is also provided for in the Hite Creek WQTC and Derek R. Guthrie WQTC service areas. The Morris Forman WQTC service area is essentially built out, meaning growth will result from customers coming online through infill of existing developed areas. In addition to expansion of the sewer system, capacity issues with pump stations have also been identified and addressed. Several pump stations have been identified that do not have adequate capacity to meet projected peak flows due to future growth. To avoid creating new SSOs, these pump stations must be expanded in advance of



the upstream collection system expansions that will bring them additional flow. The intent is to provide the needed reliable capacity in both the gravity and pumped portions of the collection system so that new connection moratoriums can be avoided.

### REGULATIONS

The recommended CIP budget also includes future projects in anticipation of regulatory changes. Increased levels of treatment for nutrients (nitrogen and phosphorus) could be imposed before the end of the planning period, which would seriously impact MSD's WQTCs. Projects to begin addressing nutrient removal requirements at all WQTCs are included in the latter years of the planning period. The timing of nutrient removal regulations will govern when these projects are actually implemented.

Microconstituent removal has also been identified as a potential future regulatory requirement. While the imposition of standards requiring microconstituents removal is not anticipated with the 20-year planning window, preliminary concepts have been developed and placeholder budgets recommended to address this potential future need. These placeholder budgets are not in the recommended 20-year CIP. The timing of microconstituent removal regulations will govern when these projects are actually implemented.

### **STORMWATER MANAGEMENT**

Stormwater management is a vital component of MSD's system, because it directly impacts the health and safety of all Louisville and Jefferson County residents. The recommended 20-year CIP includes a number of programs related to drainage and internal floodplain management. In 1987, MSD took over stormwater management and Ohio River flood protection through a Memorandum of Agreement with the City of Louisville (pre-merger with Jefferson County), and most of the small cities within Jefferson County. In 1988, MSD completed a *Stormwater Drainage Master Plan* (URS Corporation et al., 1988) that addressed the backlog of known drainage and flooding problems and planned for improvements in overall drainage and flood protection for the service area. MSD began implementing the recommendations of the *Stormwater Drainage Master Plan* on a prioritized basis, within the budget limitations imposed by the insufficient revenue generated through drainage fees. The flood of 1997 diverted the focus of stormwater management to deal with specific vulnerabilities exposed by that severe flooding event.

### PROJECT DRAINAGE RESPONSE INITIATIVE

Drainage problems create health and safety impacts for citizens directly at their homes, schools, businesses, and transportation routes. Beginning in 2003, MSD initiated an aggressive program to address a wide variety of drainage issues that were pointed out by customers. This Drainage Response Initiative program, dubbed Project DRI, assigned experienced project managers, contractors, and inspectors to address drainage problems on a "grade-to-drain" basis. Efforts under this program address problems ranging from structural flooding to alleviating minor standing water problems. Since 2003, most funds available through drainage fees have been allocated to Project DRI, with more than \$125 million in capital drainage improvements completed through this program. While MSD originally

thought that Project DRI would be phased out as the backlog of customer drainage issues were resolved, customer drainage requests continue to be among the most common communication received by MSD's Customer Relations Department. These requests are likely due to drainage impacts of land use changes, the increase in the amount of impervious surfaces across Jefferson County, the increased frequency of extreme storm events, and the degradation of drainage facilities due to aging. MSD's experience has proven that having the ability to respond quickly to individual property owner's drainage concerns is a vital part of providing quality service and building customer satisfaction. Project DRI has proven to be a very valuable program for MSD's customers, and the recommended 20-year CIP includes an annual allocation of \$2.8 million to \$5 million per year to sustain it.

### STORMWATER DRAINAGE MASTER PLAN

Given the public concern over the effects of the increased frequency of extreme storm events, the localized drainage solutions offered by Project DRI need to be supplemented with a program to address issues of stormwater management and flood protection on a countywide or watershed basis. To increase the public health and safety protection and provide a consistent level of protection for the entire service area, a significant increase in spending for drainage and flood protection is required.

Subsequent to the 1988 *Stormwater Drainage Master Plan*, the primary countywide stormwater planning completed by MSD has related to internal (that is, not related to the Ohio River) floodplain management. MSD and the Kentucky Division of Water have completed studies in most watersheds to update the Federal Emergency Management Agency (FEMA) Special Flood Hazard Areas and Local Regulatory Floodplains. These studies rely on rainfall IDF information that reflect historical observations. The Facility Plan Team has projected IDF information out to 2035 for long-range planning. Because the conditions projected for 2035 are not based on observed data, the updated floodplain information should not be used for regulatory purposes, but it can be used to inform potential property owners of the risks associated with potential future extreme storm events.

While MSD requires plans for new development to document no adverse impacts on downstream flooding, the cumulative effects of land use changes within the existing developed areas prior to MSD assuming responsibility for stormwater management may not have been subject to the same level of scrutiny. While the hydrologic and hydraulic models used for drainage planning have been updated to reflect recent land use changes, most have not been analyzed comprehensively for drainage issues outside of the Special Flood Hazard Areas or Local Floodplains to allow potential downstream impacts of new projects to be identified.

An update to the comprehensive countywide stormwater master plan is recommended to be initiated as one of the first recommendations from the stormwater portion of this Facility Plan. While current development standards require mitigating drainage impacts of land use changes, analysis of historical trends shows a significant reduction in natural green space and an increase in impervious surfaces within Jefferson County. In addition to addressing the potential impact of the increased frequency of extreme storms, the master plan should also consider a strategy to restore some of these surfaces to natural pervious conditions, which can have a significant impact on the amount of infrastructure that will be needed to address future needs. This plan should address floodplain management definition and



non-floodplain related drainage problems in an integrated approach to deal with this highly visible MSD service.

#### EARLY ACTION PROJECTS

While the comprehensive stormwater master plan is being updated, MSD's customers expect immediate action to begin addressing stormwater issues. MSD and the Facility Plan Team have identified several areas across Jefferson County with a history of drainage problems primarily related to localized drainage, not directly related to floodplain management issues.

#### PROPOSED COMPREHENSIVE STORMWATER MASTER PLAN IMPLEMENTATION

Allowances have been established in the recommended 20-year CIP to provide for implementing the proposed stormwater master plan. The recommended budgeted amounts were identified through extrapolation of the Early Action Plan projects described previously to the entire county. The intent is to provide the entire county with updated and expanded stormwater management facilities to consistently meet the level of protection of a 10-year storm, using stormwater IDF targets projected for the end of the planning period. Based on an extrapolation of project costs developed for the Early Action Plan projects, the funding required for these projects is anticipated to exceed \$600 million over the 20-year planning period. The Facility Plan Team deemed it critical to establish reasonable placeholder numbers in the long-range financial plan to be developed as part of this Facility Plan.

#### VIADUCT FLOODING

MSD is responsible for managing drainage from 32 viaducts that are subject to flooding during storm events. Some viaducts become completely impassable in relatively minor storms. Viaduct flooding disrupts transportation routes and creates potentially hazardous conditions when flooded roads are not barricaded in a timely manner or when drivers ignore the barricades and drive under the viaducts anyway. The Facility Plan Team has identified conceptual drainage solutions for each viaduct for which MSD is responsible. The projects were prioritized based on the team's understanding of traffic load and perceived risk to public health and safety. Note that viaducts are a shared responsibility with Louisville Metro Public Works and the Kentucky Transportation Cabinet. Before initiating a costly viaduct drainage solution, all parties should engage in determining the best approach to improving public safety at the viaduct locations.

#### STORMWATER QUALITY MUNICIPAL SEPARATE STORM SEWER SYSTEM

The Municipal Separate Storm Sewer System (MS4) Program is a drainage-related program to improve the quality of surface waters through controls on stormwater runoff quality in Jefferson County and to protect the public health, safety, and welfare by reducing the introduction of harmful materials into the MS4s that discharge into community streams. The MS4 Program permit outlines the regulatory requirements for discharging municipal stormwater into local water bodies. Major categories for program compliance include, but are not limited to, the following:

- Public education and outreach
- Management of industrial facilities
- Stormwater pollution prevention plan creation and oversight
- Administration of construction site management (erosion prevention and sediment control)
- Post-construction controls (green infrastructure)
- Maintenance and analysis of water quality monitoring equipment and data

The current 5-year MS4 Program permit cycle began on August 1, 2011, and it establishes the Maximum Extent Practicable (MEP) effort for MS4 programs to maintain MSD compliance with the Clean Water Act. MSD uses green infrastructure techniques—such as infiltration, rain gardens, and basin retrofits—to offset the need and costs on conventional facilities such as storage basins. Green infrastructure has proven to effectively reduce volume in the CSS, and for water quality improvements for treatment of runoff in MS4 areas. Requirements for new construction include these types of practices to control the 80th percentile event (0.6 inch of rain) in Louisville Metro. MSD funding is available for construction cost offsets in the CSS area and potential stormwater fee credits in the MS4 areas. Funding commitments for this program were defined in the IOAP and have been retained in the Facility Plan recommended CIP.

The Facility Plan identified several large stormwater retention basins with the potential for conversion of all or part of the basin to provide infiltration of stormwater. These projects are identified to be completed within the first 5 years of the CIP, providing very cost-effective green infrastructure solutions on a large scale.

#### FLOODPLAIN MANAGEMENT—FLOOD RESPONSE FUND

As of December 2016, MSD has purchased approximately 200 homes through federal grant programs since the 1997 flood and is currently working on 13 open grant projects to purchase additional homes located in flood prone areas. MSD also has 9 grant applications under review by FEMA. These grant applications include an additional 56 flood-prone properties that could be mitigated through acquisition.

Following a number of spring flooding events in 2015, the Mayor formed a multiagency Flood Mitigation Workgroup to address impacted residents who were unable, for a variety of reasons, to get back in their homes after the floodwaters receded. The Flood Mitigation Workgroup recommended several mitigation approaches, including establishment of a “quick-buy” program to allow property owners to sell flood-impacted property in a much shorter time than would typically be possible. The MSD Board approved allocation of \$1.5 million from the FY2016 budget to fund this program. The Flood Mitigation Workgroup recommended an annual fund be established to provide timely relief to property owners impacted by future extreme storm events.

The resulting Flood Response Fund proved to be a vital part of the community’s recovery after the 2015 floods. The recommended 20-year CIP includes an annual allocation of \$4 million per year to the Flood Response Fund for various flood mitigation and response activities, including continuing the quick-buy program where appropriate, implementing small-scale flood protection projects, and applying for, administering, and providing local-share funding for FEMA and other flood relief grant programs.

## OHIO RIVER FLOOD PROTECTION SYSTEM

In 1987, as part of the Memorandum of Agreement with the City of Louisville related to drainage and flood protection services, MSD assumed responsibility for the Ohio River Flood Protection System (ORFPS). The ORFPS is critical to protecting Louisville and Jefferson County from the type of devastating flooding experienced in New Orleans following Hurricane Katrina and all along the Mississippi River when similar flood levee and pump station systems failed during the extreme high-water conditions experienced in the past decade. Louisville's ORFPS was evaluated in a Levee Safety Evaluation (LSE) by the U.S. Army Corps of Engineers (USACE) in 2015 and found to be compliant with the level of protection required by FEMA. The level of Ohio River flood protection required by FEMA incorporates a "coincident frequency analysis" that statistically determines the probability of a rain event happening at the same time as high Ohio River levels. The coincident frequency analysis found the MSD ORFPS is adequately sized to handle a 1-percent probability (100-year storm) event. MSD's local drainage design criteria calls for conveyance (pumps and pipes) to be sized for at least the 10-percent event. While meeting the FEMA 1-percent criteria in a coincident frequency analysis, several flood pumping stations would require significant expansion to achieve a capacity equivalent to a 10-percent probability event, should MSD decide to apply drainage criteria to the flood pumping stations. The LSE contained a wealth of information about minor deficiencies that need to be corrected. These items have been included in the recommended 20-year CIP.

### **Flood Pumping Stations**

Much of the ORFPS was constructed in the 1950s. Design criteria that could be located from records of this era usually indicated the flood pumping stations were intended to pump the 10-percent probability storm (10-year storm), as defined by 1950 land use patterns and pre-1950 rainfall statistics. Some design documents recommended the capacity requirements be updated at 10-year intervals to account for land use changes, among other things. To our knowledge, prior to the LSE evaluation (USACE, 2015), the capacity of these flood pumping stations has never been reassessed through comprehensive hydraulic and hydrologic modeling. As previously described, capacity assessment completed as part of the LSE study identified several flood pumping stations that do not meet the 10-percent probability storm, although their capacity is adequate to provide protection for a 1-percent probability event under a coincident frequency analysis.

In addition to capacity concerns, many flood pumping stations have original 1950's vintage electrical and mechanical equipment. For the most part, the stations are manually operated using control systems that cannot be repaired with off-the-shelf components. To assure the reliability and adequacy of the flood pumping station system, all pump stations were subject to a facility condition assessment (in addition to the USACE LSE evaluation) and hydraulic and hydrologic modeling using storm IDF's projected for 2035. The recommended 20-year CIP includes rehabilitating and/or expanding 15 of the 16 flood pumping stations in MSD's system. Given the size of these facilities, the costs are substantial, but the risks being addressed are vital to Louisville's protection against catastrophic flooding.



## Levee and Floodwall System

MSD maintains a proactive maintenance program to assure the integrity of the levee and floodwall system. In addition, the USACE biannually inspects the levee and floodwall, resulting in a report on any deficiencies noted. The recommended 20-year CIP includes continuing a proactive preventive maintenance program, in addition to the corrective actions recommended by the LSE study. These efforts are critical to protect the Louisville community from flooding.

## SUPPORT SYSTEMS

MSD owns a large inventory of rolling stock, information technology (IT) systems, and above-ground facilities that support MSD's operation of wastewater, stormwater drainage, and ORFPS services.

## CAPITAL EQUIPMENT

MSD owns more than 600 vehicles and portable equipment, ranging from passenger vehicles and pick-up trucks to large excavators and sewer-cleaning trucks. MSD has started leasing the commonly available passenger cars and pick-up trucks, which moves these costs from capital to operating budgets. The specialty equipment used in MSD's O&M activities are not available for lease, and MSD must continue to own them to be certain they are available any time they are required. This equipment is critical to MSD's ability to complete the preventive and corrective maintenance activities required to provide sustainable and reliable wastewater, stormwater, and flood protection services. For example, a comprehensive sewer inspection activity requires a sewer flush truck to clean the sewer, a vactor truck to capture the material flushed from the line to prevent it from moving downstream to cause problems elsewhere, and a closed-circuit television truck to closely inspect the condition of the pipe. After the condition is established, either heavy construction equipment like excavators and loaders or specialty equipment to install cured-in-place sewer lining is used to correct deficiencies. The specialized equipment is very expensive to purchase and maintain, given the severe service conditions that this equipment is operated under. The recommended 20-year CIP includes an annual allowance for equipment repair and replacement.

## FACILITIES

The Facility Plan Team completed a facility condition assessment of more than 200 buildings and recommended corrective actions where deficiencies were noted. The main areas of deficiency were in roofs; MSD has above-ground buildings with roofs all over Jefferson County, ranging from the massive roof system at the Central Maintenance Facility to the little roof over a 10-foot-by-10-foot pump station building. Roofs appear to be one area that MSD allows to "run to failure." Roofs are seldom replaced until a leak is detected inside the building. The Facility Plan recommends an extensive program of roof replacement in the first 5 years, using standardized roofing systems for different applications. After that, regular inspection and replacement before failure occurs is recommended to provide the minimum cost of ownership for the buildings protected by these roofs.



The facility condition assessments also identified a number of deficiencies in areas related to heating, ventilation, and air conditioning (HVAC), building egress, signage and ancillary equipment, and indications of conditions that could eventually cause structural issues and even structural failure. The recommended 20-year CIP includes projects to address the specific recommendations identified by the Facility Plan Team, with future budgets recommended to complete periodic facility condition assessments following deficiency correction.

#### INFORMATION TECHNOLOGY SYSTEMS AND LOUISVILLE AND JEFFERSON COUNTY INFORMATION CONSORTIUM SUPPORT

MSD maintains an extensive inventory of IT hardware and software that is essential to overall agency operations; this includes the MSD intranet system that is the backbone of MSD electronic communication and digital data generation, communication and storage, and regulatory compliance reporting. This hardware and software system is also responsible for supplying the internet connection to MSD's supervisory control and data acquisition (SCADA) system that controls more than 300 pump stations and control gates and serves as the platform for implementing the RTC system. This RTC system is used to optimize use of MSD's conveyance facilities to cost-effectively maximize the use of existing facilities to reduce sewer overflows. Without adequate and updated IT systems, public health and safety could be at risk. This inventory is subject to periodic upgrade and replacement like all MSD's other assets. In addition, MSD hosts the Louisville and Jefferson County Information Consortium (LOJIC) systems, which similarly require periodic upgrades and replacements to hardware and software. The recommended 20-year CIP includes annual allowances to account for these anticipated future costs.

#### **FINANCE**

To implement a \$4.3 billion capital program and the associated costs to operate new facilities, MSD must have the funding to pay for it. Unlike the IOAP, which is required by the Consent Decree to be completed, most stormwater management and flood protection capacity projects developed in this Facility Plan are not specifically required by regulation. Providing for infrastructure renewal and replacement, and improving the consistent level of service in stormwater management and flood protection are local decisions driven by MSD's mission to provide safe, clean waterways for the community. MSD will implement this Facility Plan to the extent funding is provided through the rate-setting process. If sufficient funding is not provided to complete the recommended projects in the 20-year planning period, then projects will be deferred to the future, when funding comes available.

#### REVENUE REQUIREMENTS AND RATES

The MSD Board approves rates, rentals, and charges on an annual basis. The MSD Board has the authority to raise rates up to 6.9 percent per year without Metro Council approval. Rate increases higher than 6.9 percent require Metro Council approval. The CIP recommended by the Facility Plan totals approximately \$4.3 billion over 20 years. The recommended CIP for FY2017 through FY2021 exceeds \$1 billion. The revenue generated by current rates, increased at 6.9 percent per year or less, will not generate enough revenue to support \$1 billion in capital spending over the next 5 years. If current rates are increased by no more than 6.9 percent per year for the next 5 years (\$3.60 per month for a typical



customer in FY2018), then approximately \$480 million in capital projects will need to be deferred. While 6.9 percent per year rate increases do provide enough revenue to implement the entire Facility Plan CIP over the 20-year planning period, the recommended schedule cannot be achieved, and completing critical public safety projects could be deferred by 3 to 5 years.

Completing the projects in the recommended CIP on the schedule recommended in the Facility Plan will require a 20-percent to 25-percent rate increase in FY2018 (\$10.50 to \$13.12 per month for a typical customer in FY2018), followed by rate increases up to 6.9 percent for the remaining years of the planning period. If a smaller rate increase is approved for FY2018, then the project schedule will need to be adjusted and recommended projects deferred to a later date based on MSD’s resulting financial capabilities and project priorities identified by MSD staff. Projects directly related to the Consent Decree or other regulatory requirements, or those that address areas of high risk, will receive the highest immediate priority. Projects that do not address regulatory requirements or mitigation of high-risk issues will be deferred until the major IOAP projects have been completed and funds are available. The project prioritization system used to determine the recommended Facility Plan schedule is available for MSD staff to determine priorities based on information available at the time the budget revisions are made.

Table 3 presents the recommended project deferrals that could be anticipated for two alternative rate increase scenarios, based on the Facility Plan prioritization approach and information available at the time the Facility Plan was drafted. The alternative funding scenarios presented represent only two of the many rate approaches possible. Table 3 illustrates that if the funding scenario does not accommodate the recommended Facility Plan projects, the CIP implementation will be focused initially on completing the IOAP and other regulatory commitments. Even projects that deal with high-risk issues may be deferred due to funding shortfalls. Table 3 also illustrates the impact of deferred funding on the overall cost of Facility Plan implementation.

Under the most limited funding scenario presented (no rate increase over 6.9% per year) \$480 million in capital projects must be deferred by 3 to 5 years. This has a ripple effect on the remainder of the 20-year cash flow, effectively pushing \$480 million in projects to the end of the planning period. While Table 3 presents the Facility Plan recommendations for deferral, actual project deferrals will be established during the annual CIP budgeting process.

**Table 3 – FY2018 – FY2020 CIP Project Deferrals Under Alternative FY2018 Rate Increases**

Project Name	Baseline CIP Budget	Reduced CIP Budget ~\$10/mo in FY18	Reduced CIP Budget ~\$4/mo in FY18
<b>Wastewater Projects</b>			
<b>CMOM</b>			
Cedar Creek WQTC Asset Management Rehabilitation and Replace	\$900,000	\$900,000	\$500,000
Cedar Creek WQTC Forcemain Extension	\$177,000	\$177,000	\$0
Cedar Creek WQTC Sand Filter Replacement	\$4,500,000	\$4,500,000	\$2,000,000



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Project Name	Baseline CIP Budget	Reduced CIP Budget ~\$10/mo in FY18	Reduced CIP Budget ~\$4/mo in FY18
Cedar Creek WQTC Service Area Inventory for Critical Pump Station	\$300,000	\$300,000	\$0
Collection System Spare Pump Inventory	\$3,000,000	\$3,000,000	\$1,300,000
Derek R. Guthrie WQTC Service Area Inventory for Critical Pump Station	\$300,000	\$300,000	\$0
Floyds Fork WQTC Service Area Inventory for Critical Pump Station	\$300,000	\$300,000	\$0
FY18 PMP	\$2,500,000	\$2,500,000	\$2,250,000
FY18-FY22 Operations Renewal and Replacement	\$18,300,000	\$18,300,000	\$15,300,000
FY19 CMOM PM Assist	\$225,000	\$187,500	\$187,500
FY19 PMP	\$2,000,000	\$2,000,000	\$1,000,000
Hite Creek WQTC Solids Expansion	\$6,800,000	\$6,800,000	\$1,500,000
Hite Creek WQTC Expansion	\$19,553,703	\$17,553,703	\$3,623,703
Land Acquisition	\$2,400,000	\$2,400,000	\$1,300,000
Lea Ann Way Pump Station Elimination	\$8,000,000	\$6,000,000	\$0
Lea Ann Way West Rehab Quad 1	\$400,000	\$400,000	\$500,000
Major Interceptor Rehabilitation	\$5,500,000	\$5,500,000	\$3,000,000
Morris Forman Collection System Baffles	\$624,000	\$400,000	\$0
Morris Forman WQTC Service Area Inventory for Critical Pump Stations	\$900,000	\$900,000	\$0
Morris Forman WQTC Service Area MH and ARV Floodproofing for 100	\$136,000	\$136,000	\$0
Morris Forman WQTC Service Area Pump Station Floodproof for 100-Year Storm	\$328,000	\$248,000	\$0
Nightingale Rehab	\$4,200,000	\$4,200,000	\$1,500,000
Slip Line JTWQTC	\$1,398,000	\$1,398,000	\$0
<b>Development</b>			
Floyds Fork Zone B Sewers	\$7,900,000	\$7,900,000	\$0
Floyds Fork Zone C Sewers	\$4,000,000	\$4,000,000	\$0
KTC Greenwood Road Assessment	\$525,000	\$0	\$0
<b>NMC</b>			
Morris Forman Central Business District CSO Cameras	\$1,248,000	\$1,248,000	\$0
Morris Forman WQTC Draft Rehab and TWAS Piping Replacement	\$1,500,000	\$1,500,000	\$0
Morris Forman WQTC Digester Lids and Mixers	\$4,500,000	\$4,500,000	\$0



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Project Name	Baseline CIP Budget	Reduced CIP Budget ~\$10/mo in FY18	Reduced CIP Budget ~\$4/mo in FY18
Morris Forman WQTC Equipment Renewal and Replacement in Year 5	\$25,500,000	\$15,000,000	\$900,000
Morris Forman WQTC Sec Clarifiers and RAS/WAS Pumping	\$6,500,000	\$5,500,000	\$0
Morris Forman WQTC Sedimentation Basin Rehabilitation	\$12,500,000	\$8,500,000	\$500,000
<b>Stormwater Projects</b>			
<b>Drainage</b>			
Auburndale Early Action Project	\$12,600,000	\$4,200,000	\$0
City of Hurstbourne Early Action Project	\$6,000,000	\$3,000,000	\$0
Master Plan Implementation	\$6,000,000	\$5,000,000	\$0
Newburg Early Action Project	\$10,250,000	\$3,000,000	\$0
Pope Lick Early Action Project	\$6,100,000	\$1,220,000	\$0
Prospect Early Action Project	\$6,000,000	\$1,500,000	\$0
Seatonville Early Action Project	\$3,400,000	\$3,400,000	\$0
Stormwater Master Plan	\$4,000,000	\$4,000,000	\$0
Ten Broeck Early Action Project	\$1,000,000	\$1,000,000	\$0
Valley Creek Early Action Project	\$5,540,000	\$3,000,000	\$0
Via11 E Brandeis Ave and Brook Viaduct Flood Relief	\$28,043,000	\$2,000,000	\$0
Via16 3rd and Eastern Pky Viaduct Flood Relief	\$5,808,000	\$0	\$0
Whispering Hills Early Action Project	\$2,560,000	\$2,560,000	\$0
<b>Floodplain Management</b>			
Flood Response-Buyouts Mitigation and Grants	\$12,000,000	\$10,000,000	\$0
<b>Ohio River Flood Protection</b>			
10th Street Flood Pumping Station Reliability / Generator	\$1,035,000	\$0	\$0
17th Street Flood Pumping Station Capacity / Reliability / Generator	\$2,525,000	\$2,525,000	\$0
34th Street Flood Pumping Station to Los 5 - Improvements / Generator	\$2,000,000	\$0	\$0
5th Street Flood Pumping Station to Los 5 - Improvements / Generator	\$820,000	\$0	\$0
Allocation - Annual Flood Pumping Stations Equipment Renewal and Replacement	\$3,000,000	\$3,000,000	\$2,500,000



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Project Name	Baseline CIP Budget	Reduced CIP Budget ~\$10/mo in FY18	Reduced CIP Budget ~\$4/mo in FY18
Floodwall and Levee Risk Assessment	\$750,000	\$0	\$0
Floodwall/Levee Repair and Toe Drains	\$2,250,000	\$2,250,000	\$1,500,000
Levee and Floodwall Repair and Renewal Light	\$1,875,000	\$1,500,000	\$750,000
Paddys Run Flood Pumping Station Reliability / Redundant Service	\$31,575,000	\$8,000,000	\$0
Robert J. Starkey Flood Pumping Station Operational Improvements	\$4,360,000	\$2,180,000	\$0
Western Parkway Flood Pumping Station –Capacity Improvements	\$11,648,000	\$4,648,000	\$0
Western Parkway Flood Pumping Station - Reliability Improvements (Evaluation Repairs)	\$3,334,000	\$3,334,000	\$0
<b>Support Systems Projects</b>			
<b>Capital Equipment</b>			
FY18 Vehicles & Equipment	\$3,500,000	\$3,500,000	\$2,000,000
FY19 Vehicles & Equipment	\$3,500,000	\$3,500,000	\$1,500,000
FY20 Vehicles & Equipment	\$3,500,000	\$3,500,000	\$2,500,000
Systems Automation	\$1,200,000	\$750,000	\$750,000
<b>Facilities</b>			
Admiral Pump Station Foundation Repairs	\$246,936	\$246,936	\$246,936
Louisville Green Major Maintenance	\$3,000,000	\$3,000,000	\$1,000,000
Morris Forman WQTC Elevator Repairs	\$400,000	\$400,000	\$0
Miscellaneous Facility Repairs	\$127,566	\$127,566	\$127,566
Roof Replacements	\$3,230,458	\$3,204,950	\$3,200,000

**RATE RELIEF**

While increased spending on infrastructure is needed, the affordability of utility services is a serious concern for those in our community, especially those who are living at or near poverty levels. To avoid imposing additional stressors on the low-income population of our community, MSD is investigating the concept of meaningful rate relief for those in need. To provide the benefits of a significant wastewater rate reduction for low-income customers, a small incremental increase in costs (approximately \$1.30 per month) would apply for a typical customer in 2018. These costs are passed on to customers who are better able to absorb it in their household budgets.

To implement this, MSD has partnered with the Metro Department of Community Services (Community Services). Community Services currently administers the Low-Income Home Energy Assistance Program



(LiHEAP). Community Services has agreed in principle to administer a rate relief program for MSD, based on the qualification standards used in the LiHEAP program. Subject to MSD Board approval, MSD is considering a rate relief subsidy proportional to annual rate increases, for customers who qualify. The current Low-Income Senior Citizens Discount Program is expected to be phased out, but seniors would be “grandfathered” into the new rate relief program regardless of LiHEAP qualification standards.

## **SUMMARY**

The 20-year Comprehensive Facility Plan represents MSD’s most ambitious planning effort in a decade. Working with the Wet Weather Team Stakeholder Group and MSD staff, the Facility Plan Team reviewed the challenges our community faces now and in the future and has developed a roadmap to protect the area’s health, economic vitality, and environment. The recommendations in this plan are the result of well-vetted analyses from some of the most experienced engineers in Louisville Metro. The recommendations are essential to maintaining reliable and properly sized facilities that will allow MSD to fulfill its responsibility for safe, clean waterways and to help preserve and promote our competitiveness as a city.

Wastewater collection and treatment is MSD’s largest service offering and was the original reason MSD was formed by state statute in 1946. Fully implementing the Facility Plan recommendations will accomplish the following wastewater service objectives:

- Fulfill the obligation of the Consent Decree, including completing all the projects contained in the IOAP on schedule
- Provide facilities that comply with the other environmental regulations MSD is governed by and provide a plan to remain in compliance with future regulations currently under development
- Renew and replace aging wastewater infrastructure to provide reliable service and the lowest overall cost using a best-practice asset management approach
- Position MSD to support the community’s ability to grow responsibly as economic development opportunities become available

MSD assumed responsibility for stormwater management, including both drainage and interior floodplain management for most of Jefferson County in 1987. The drainage system at that time had a backlog of thousands of drainage complaints that MSD was expected to correct. While MSD has invested hundreds of millions of dollars in drainage infrastructure since 1987, drainage problems still are found across the entire county. In addition, the increased frequency of extreme storms that have been observed in Louisville Metro have raised customer concerns about the adequacy of our drainage and interior floodplain management systems. While current development standards require mitigation of the drainage impacts of land use changes, analysis of historical trends shows a significant reduction in natural green space and an increase in impervious services that do not allow stormwater to seep into the ground. Runoff from impervious surfaces also causes increased runoff volume and greatly increased runoff peak flows. Together, these factors exacerbate the observed deficiencies in the stormwater system that MSD now has responsibility for, impacting neighborhood drainage in addition to interior

floodplain inundation. Implementing the Facility Plan recommendations will accomplish the following stormwater management objectives:

- Improve the level of protection against public health and property risks caused by inadequate stormwater drainage systems
- Continue support for the Project DRI neighborhood drainage solutions
- Expand the efforts of the MS4 program to reduce stormwater contamination of our waterways, primarily through BMPs and continued proactive support of green infrastructure solutions to both quantity and quality concerns
- Recognize and respond to the impact of changing weather patterns including the increased frequency of extreme storms

The ORFPS was developed in response to the flood of 1937. The system of levees, floodwalls, and flood pumping stations have protected Louisville since it became operational in the 1950s. While the system has an outstanding record of reliability, much of the system is more than 60 years old and includes antiquated equipment that cannot be repaired with standard parts available today. In addition, the same changing precipitation and land use patterns that affect drainage and inland floodplain management also impact the flood pumping stations and related appurtenances. Implementing the Facility Plan recommendations will accomplish the following ORFPS objectives:

- Maintain protection from Ohio River floods entering Louisville by proactive preventive and predictive maintenance activities related to the levee, floodwall, and all gates and other penetration closures that keep floodwaters at bay
- Modernize the flood pumping stations with current mechanical and electrical equipment that can provide continued reliability and a predictable cost because parts will be more readily available at a more reasonable cost
- Expand the capacity of those flood pumping stations to enhance community protection in response to changing precipitation and land use patterns

Implementing the recommendations for all three service areas in accordance with the schedule presented will require a significant investment from the community, which may mean a step-change increase in wastewater and drainage rates. If the community is unwilling to accept the rate increases necessary to fund the recommended project schedules presented, then many important projects will not be able to be implemented in the near term. The data indicate that not implementing necessary investments is almost certain to result in more infrastructure failures, an increase in the overall cost of implementing the Facility Plan, and an ever more rapidly increasing likelihood of a failure that could have serious consequences for the residents and businesses that make Louisville Metro their home.

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## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### ACRONYMS AND ABBREVIATIONS

@	at
/	divided by
\$	dollar
%	percent
+	plus
ACD	Amended Consent Decree
ACES	Asset Condition Evaluation System
BAB	Build America Bonds
BOD	biochemical oxygen demand
CCTV	closed-circuit television
C/I	commercial/industrial
CIP	capital improvement plan
CMF	Central Maintenance Facility
CMOM	Capacity, Management, Operations, and Maintenance
CSO	combined sewer overflow
CSS	combined sewer system
CWA	Clean Water Act
CWIP	construction work in progress
DSCR	Debt Service Coverage Ratio
ENR-CCI	<i>Engineering News Record</i> Construction Cost Index



EPA	U.S. Environmental Protection Agency
EQM	equivalent meter
ESU	equivalent service unit
Facility Plan	20-Year Comprehensive Facility Plan—Critical Repair and Reinvestment Plan
FEMA	Federal Emergency Management Agency
FPS	flood pumping station
FY	fiscal year
GIS	geographic information system
hr	hour
HVAC	heating, ventilation, and air conditioning
I/I	inflow and infiltration
IIMM	International Infrastructure Management Manual
IOAP	Integrated Overflow Abatement Plan
IT	information technology
IWD	Industrial Waste Department
KDEP	Kentucky Department of Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
Kgal	thousands of gallons
kWh	kilowatt-hour
lbs	pounds
LiHEAP	Low-income Home Energy Assistance Program
LOJIC	Louisville/Jefferson County Information Consortium



LSE	Levee System Evaluation
LWC	Louisville Water Company
MEP	maximum extent possible
MG	million gallons
mg/L	milligrams per liter
MGD	million gallons per day
MHI	Median Household Income
MOR	Monthly Operating Report
MOU	memorandum of understanding
MS4	Municipal Separate Storm Sewer System
MSA	Metropolitan Statistical Area
MSD	Louisville and Jefferson County Metropolitan Sewer District
N	nitrogen
N/A	not applicable
NH <sub>3</sub>	ammonia
NMC	Nine Minimum Controls
O&M	operations and maintenance
OGA	Oxygen Generation Area
ORFPS	Ohio River Flood Protection System
P	phosphorus
PM	private meter
Project DRI	Project Drainage Response Initiative



RRF	risk-reduction factor
RTC	real-time control
SCADA	supervisory control and data acquisition
SORP	Sewer Overflow Response Protocol
SSO	sanitary sewer overflow
SWMP	stormwater master plan
TKN	total Kjeldahl nitrogen
TN	Tennessee
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
WEF	Water Environment Federation
WQTC	water quality treatment center
WWT	Wet Weather Team



## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### EXECUTIVE SUMMARY

In January 2014, the Louisville and Jefferson County Metropolitan Sewer District (MSD) Board adopted a new Strategic Business Plan (MSD, 2014) that defined a change agenda for MSD. The intent of the Strategic Business Plan is to dramatically improve customer care and service; make appropriate investments in technology, infrastructure, and employees; and improve the quality of life in Louisville and Jefferson County while maintaining the financial viability of the utility. A key part of MSD's plan to implement the Strategic Business Plan is to develop this 20-Year Comprehensive Facility Plan (Facility Plan).

The purpose of this Facility Plan is to consolidate MSD's planning and apply consistent pricing and prioritization for facility rehabilitation, renewal, replacement, upgrade, and expansion across its service areas. For the past 10 years, much of MSD's focus has been to ensure compliance with the requirements of the Amended Consent Decree.<sup>1</sup> Due to limited resources and the community's desire to maintain sewer and drainage rates at or below the national average, developing and implementing the Integrated Overflow Abatement Plan (IOAP; MSD, 2009) has taken the focus off infrastructure renewal and repair for facilities not related to sewer overflow control. While the IOAP implementation is only half finished, the consequences of deferred rehabilitation and renewal are beginning to show in all MSD's service areas. When implemented, the infrastructure improvements recommended by the plan are intended to accomplish the following:

- Protect the public health and safety of the community
- Protect the aquatic and terrestrial environment
- Meet customer expectations for a consistent level of service
- Comply with all federal and state laws, regulations, orders, and standards

The Facility Plan also considers the operating costs, including staff increases, to accommodate operations and maintenance of new facilities coming online under the IOAP and this Facility Plan.

A key part of the Facility Plan is a recommended 20-year capital improvement plan (CIP). Projects in the recommended 20-year CIP included current and ongoing projects with approved budgets and additional projects determined by the Facility Plan Team to address critical needs requiring correction over the next 20 years. Another key objective of the Facility Plan is more consistency of service for ratepayers across the entire Louisville community. The goal is to provide protection from a storm with a 10-percent probability of exceedance in any year (commonly known as a 10-year storm) for wastewater, drainage,

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<sup>1</sup> The Commonwealth of Kentucky, Plaintiff, and the United States of American, Plaintiff-Intervener, v. Louisville and Jefferson County Metropolitan Sewer District, Defendant, in the United States District Court, Western District of Kentucky, Louisville Division. Amended Consent Decree, Case 3-08-cv-00608-CRS. Filed April 15, 2009. Available at <http://www.msdpjprojectwin.org/Portals/0/Library/Consent%20Decree/Agreement/Commonwealth%20of%20KY%20vs%20MSD%20%20Amended%20Consent%20Decree.pdf>.



and flood protection services for customers within the MSD service area by the end of the 20-year planning period. Currently, the most recently constructed areas in the community are designed to provide basic drainage and flood protection to a 4.5-inch rainstorm occurring in 24 hours (this is the 10 percent probability storm per MSD's current design manual). However, many of the older neighborhoods in the service area that were constructed before MSD assumed responsibility for drainage begin experiencing localized flooding and drainage problems in a 3-inch rainstorm that occurred during a 24-hour period.

MSD strongly believes that the Louisville community deserves to be informed on these matters of public health and safety, and likewise, should have a voice in the conversation about the timing of necessary infrastructure investments. MSD committed to facilitating discussions with customers, business leaders, elected officials and others. With this overall goal, MSD undertook the wide-reaching "Community Conversation" initiative described in Volume 1 Section 2, aimed at bringing many perspectives to the table for constructive dialogue. This dialogue did not center around *if* the risks to the public health and safety of families and business owners will be addressed, but rather *how soon should the work begin*.

Community input confirms that Louisville supports restoring its vital wastewater, flood protection, and stormwater management facilities. Responses from those who engaged in the community conversation are as follows:

- 90 percent of respondents understand and agree with the need for investing in the community's wastewater, stormwater, and flood protection systems to reduce risks to public health and safety rather than continuing to defer critical repairs and reinvestment.
- 89 percent of respondents believe beginning to address the public health and safety risks as quickly as possible is important.
- 71 percent of respondents support an increase in residential rates of up to \$10 per month (with a proportional increase in industrial and commercial rates) to immediately begin to fund critical wastewater, stormwater, and flood protection needs to address public health and safety risks.
- 78 percent of respondents support expanding MSD's Rate Relief Program to assist customers who meet federal criteria established for other utility rate assistance programs.

This input echoes the priorities identified by local citizens at the 100 Resilient Cities Workshop hosted by Louisville Metro in early 2017, including the risks of severe or catastrophic weather, infrastructure vulnerability, and aging infrastructure.

## ES.1 PROJECT DEVELOPMENT

The Facility Plan identified projects through several pathways. MSD's current CIP contained over 100 projects related to wastewater, stormwater management, and Ohio River flood protection systems. If these projects were already in design or construction, they were included in the recommended 20-year CIP without change. If the projects were not in design or construction, the project needs were identified and the costs verified. These projects were then subject to prioritization along with each of the other projects. The IOAP, prepared in response to MSD's federally mandated Consent Decree, has several very

large projects still to construct. These projects are required to be completed within the schedule presented in the approved IOAP. No changes were made to the IOAP projects or their schedules.

MSD has several existing planning studies related to wastewater that have not been fully implemented. The Facility Plan Team evaluated existing studies and found many worthwhile projects that were not included in the previous CIP. These projects were evaluated and included in the project mix for prioritization. Finally, the Facility Plan Team looked for gaps in previous planning. This included a review of population projections, an assessment of regulatory changes that might occur during the 20-year planning period, and a condition assessment of facilities that included staff interviews, visual inspections, and in some cases diagnostic measurements.

## **ES.2 PROJECT EVALUATION AND PRIORITIZATION**

Project evaluation and prioritization requires a rigorous and transparent approach. The values-based benefit/cost approach used to develop the IOAP was very successful in this regard, and to the extent possible was replicated in developing the Facility Plan. Given the variety of ways that projects were identified and developed, capital and operating cost estimating used a variety of sources. The IOAP Cost Tool was used to develop project costs where applicable (such as new projects with standard components like sewers and pump stations). Where the IOAP cost tool could not be applied, the team used industry-standard cost references such as RSMeans. When similar MSD projects were available, the estimating was done using unit prices from those projects.

The prioritization of projects followed the values-based benefit/cost evaluation used successfully in the development of the IOAP. The Wet Weather Team Stakeholder Group was rechartered to serve a similar role in helping to guide the Facility Plan development. Many of the original members chose to continue serving on this team. Recognizing the broader scope of the Facility Plan, several new members representing different interest groups and demographics were added to the Stakeholder Group. The values-based benefit/cost evaluation developed scoring scales to grade projects on their effectiveness at protecting the community in the following values:

- Environmental Protection
- Public Health Protection
- Regulatory Compliance
- Sustainability
- Property Protection
- Economic Vitality

The values-based benefit scores were coupled with life-cycle cost information to develop a benefit/cost score used for the first round of project prioritization. This approach was then supplemented with an evaluation of the effectiveness of the project in avoiding risk. The combination of benefit/cost and risk management was the primary way that projects were evaluated. This process is described in detail in Volume 1, Chapter 3.

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### **ES.3 ASSUMPTIONS**

The basis for project development and pricing includes several assumptions. While many of these assumptions are specific to the project service type, some of the assumptions are common to all projects and all service types. These common assumptions are as follows:

- Cost estimates for projects were developed using standardized cost estimating guides based on 2016 dollars.
  - Project costs in the current CIP are assumed to have already been escalated to account for project timing, and are not adjusted further for inflation.
  - New project costs developed by the Facility Plan Team have been escalated at 3 percent compounded annually, which closely matches the long-term inflation rate reflected in both the Consumer Price Index and the *Engineering News Record's* Construction Cost Index. Both indices are strongly affected by regional, national, and global economic trends so the actual inflation at any given time may be different than a uniform 3 percent, but will be consistent over the entire 20-year period, in line with the trends in price increases experienced over the past 60 years.
- For projects affected by national or state regulatory programs, no significant change in current regulations are anticipated in the first 10 years.
  - Based on trends observed around the country and elsewhere in U.S. Environmental Protection Agency (EPA) Region 4, changes in the Municipal Separate Storm Sewer System (MS4) regulations are anticipated in the 10- to 15-year timeframe.
  - Changes in the Kentucky Pollutant Discharge Elimination System (KPDES) standards are anticipated in the 15- to 20-year timeframe, with some preparatory work being started in advance of the new regulatory requirements.
- For drainage and flood protection services, the Facility Plan objective is to provide protection from a 10-percent probability storm (10-year storm) to customers within the service area by the end of the planning period.
  - For projects directly affected by precipitation events, the Facility Plan Team has projected rainfall intensity, duration, and frequency (IDF) curves for the year 2035. This projection considers both statistical trends going back 60 years, along with state-of-the art global circulation models that project future IDF conditions. This reflects the observed increased frequency of extreme storms.
  - MSD's current design criteria for facilities (based on published storm recurrence intervals) will apply to new facilities planned as appropriate, with revised IDF curves applied to the recurrence intervals in the criteria. For example, stormwater culverts under secondary roadways will continue to be designed to the 10 percent probability storm (commonly known as the 10-year storm), but the 24-hour rainfall value used in the calculations reflects precipitation projections for the end of the 20-year planning period (2035). The Facility Plan recommends that MSD's design standards be modified to incorporate the projected 2035 IDF curves in the requirements for new construction.



**ES.4 20-YEAR CAPITAL IMPROVEMENT PLAN**

Table ES-1 summarizes the recommended 20-year CIP, broken down by service area and major program. The values have been escalated at 3 percent per year compounded to the time that funds are actually expended. Table ES-2 summarizes the first 5 years of the recommended 20-year CIP, broken down by year, service area, and major program.

**Table ES-1. Recommended 20-Year Capital Improvement Plan Summary**

Service Area and Program	Capital Cost (in escalated dollars)				Total FY2017 through FY2036
	FY2017 through FY2021	FY2022 through FY2026	FY2027 through FY2031	FY2032 through FY2036	
<b>Wastewater</b>	<b>\$848.0 million</b>	<b>\$392.3 million</b>	<b>\$353.7 million</b>	<b>\$262.6 million</b>	<b>\$1,856.5 million</b>
Consent Decree (IOAP)	\$564.6 million	\$26.5 million	\$.4 million	\$.0 million	\$591.5 million
NMC	\$116.2 million	\$33.2 million	\$35.1 million	\$40.0 million	\$224.5 million
CMOM	\$144.2 million	\$275.7 million	\$184.4 million	\$201.1 million	\$805.4 million
Development	\$23.0 million	\$56.9 million	\$133.8 million	\$21.5 million	\$235.2 million
<b>Stormwater</b>	<b>\$348.8 million</b>	<b>\$623.7 million</b>	<b>\$636.2 million</b>	<b>\$734.7 million</b>	<b>\$2,343.4 million</b>
Drainage	\$189.8 million	\$403.0 million	\$394.0 million	\$529.7 million	\$1,516.5 million
Floodplain management	\$19.8 million	\$25.4 million	\$29.4 million	\$34.1 million	\$108.6 million
Ohio River Flood Protection	\$128.1 million	\$175.6 million	\$191.2 million	\$145.9 million	\$640.9 million
Stormwater Quality (MS4)	\$11.2 million	\$19.8 million	\$21.5 million	\$25.0 million	\$77.5 million
<b>Support Systems</b>	<b>\$43.5 million</b>	<b>\$28.7 million</b>	<b>\$24.9 million</b>	<b>\$27.4 million</b>	<b>\$124.5 million</b>
Capital Equipment	\$11.3 million	\$14.7 million	\$16.7 million	\$19.0 million	\$61.8 million
Facilities	\$27.7 million	\$8.3 million	\$3.2 million	\$2.7 million	\$41.9 million
IT	\$3.1 million	\$3.8 million	\$3.1 million	\$3.6 million	\$13.6 million
LOJIC	\$1.4 million	\$1.9 million	\$1.8 million	\$2.1 million	\$7.3 million
<b>Total Escalated Costs</b>	<b>\$1,240.4 million</b>	<b>\$1,044.7 million</b>	<b>\$1,014.7 million</b>	<b>\$1,024.7 million</b>	<b>\$4,324.5 million</b>



**Table ES-2. Recommended 5-Year Capital Improvement Plan Summary**

Service Area and Program	Capital Cost (in escalated dollars)					Total FY17 through FY21
	FY17	FY18	FY19	FY20	FY21	
<b>Wastewater</b>	<b>\$150.8 million</b>	<b>\$188.1 million</b>	<b>\$210.0 million</b>	<b>\$161.1 million</b>	<b>\$138.0 million</b>	<b>\$848.0 million</b>
Consent Decree (IOAP)	\$109.9 million	\$139.5 million	\$154.4 million	\$89.7 million	\$71.1 million	\$564.6 million
NMC	\$19.7 million	\$21.3 million	\$25.9 million	\$26.7 million	\$22.6 million	\$116.2 million
CMOM	\$18.6 million	\$25.1 million	\$24.1 million	\$35.7 million	\$40.7 million	\$144.2 million
Development	\$2.6 million	\$2.2 million	\$5.6 million	\$9.0 million	\$3.6 million	\$23.0 million
<b>Stormwater</b>	<b>\$19.1 million</b>	<b>\$40.8 million</b>	<b>\$63.7 million</b>	<b>\$93.0 million</b>	<b>\$132.3 million</b>	<b>\$348.8 million</b>
Drainage	\$4.2 million	\$16.2 million	\$31.8 million	\$59.7 million	\$77.9 million	\$189.8 million
Floodplain Management	\$1.6 million	\$4.6 million	\$4.4 million	\$4.5 million	\$4.6 million	\$19.8 million
Ohio River Flood Protection	\$11.4 million	\$18.3 million	\$25.6 million	\$26.8 million	\$46.0 million	\$128.1 million
Stormwater Quality (MS4)	\$1.9 million	\$1.7 million	\$1.9 million	\$1.9 million	\$3.7 million	\$11.2 million
<b>Support Systems</b>	<b>\$12.5 million</b>	<b>\$5.5 million</b>	<b>\$7.0 million</b>	<b>\$7.4 million</b>	<b>\$11.2 million</b>	<b>\$43.5 million</b>
Capital Equipment	\$.6 million	\$1.4 million	\$1.9 million	\$2.4 million	\$5.0 million	\$11.3 million
Facilities	\$10.2 million	\$3.1 million	\$4.7 million	\$4.2 million	\$5.7 million	\$27.7 million
IT	\$1.6 million	\$.7 million	\$.3 million	\$.3 million	\$.3 million	\$3.1 million
LOJIC	\$.1 million	\$.4 million	\$.1 million	\$.5 million	\$.3 million	\$1.4 million
<b>Total Escalated Costs</b>	<b>\$182.4 million</b>	<b>\$234.5 million</b>	<b>\$280.7 million</b>	<b>\$261.4 million</b>	<b>\$281.5 million</b>	<b>\$1,240.4 million</b>



## **ES.5 SIGNIFICANT SERVICE AREA PROJECTS AND PROGRAMS**

The following sections will address each of the MSD service areas, along with support services, describing specific assumptions that drove project development.

### **ES.5.1 Volume 2—Wastewater**

For the past 10 years much of MSD's focus has been to ensure compliance with the requirements of the Amended Consent Decree. Due to limited resources and the community's desire to maintain sewer and drainage rates at or below the national average, developing and implementing the IOAP has taken the focus off infrastructure renewal and repair for facilities not related to sewer overflow control. In addition, the weak economy from 2008 to 2012 also reduced the pressure to provide new wastewater service to developing areas. While the IOAP implementation is only half-finished, the consequences of deferred rehabilitation and renewal are beginning to show in the increased number of sewer collapses, including multiple problems with the Broadway Interceptor (constructed in 1867) and its connecting lines. With the local economy strengthening, MSD is seeing much more interest from the development community to provide sewer service to growth areas across the county. The Facility Plan addresses each of these issues, as described in the following sections.

#### **ES.5.1.1 Consent Decree (Integrated Overflow Abatement Plan)**

On August 12, 2005, MSD entered into a Consent Decree in Federal Court with the EPA and the Kentucky Department of Environmental Protection (KDEP) and the Public Protection Cabinet. The Consent Decree was developed in response to an enforcement action taken by EPA and KDEP alleging violations of the Clean Water Act (CWA) primarily related to sewer overflows. The stated objective of the Consent Decree is to further the objectives of the CWA; eliminate unauthorized discharges from MSD's separate sewer system, combined sewer system (CSS), and water quality treatment centers (WQTCs); and address discharges from MSD's combined sewer overflow (CSO) locations identified in the KPDES permit for the Morris Forman WQTC. The Consent Decree outlines the compliance program and schedules for achieving specific objectives, including the development of discharge abatement plans.

On December 1, 2008, a draft Amended Consent Decree was released for public comment. The draft decree addressed alleged violations of the CWA primarily related to WQTC performance, record-keeping, and reporting. The public comment period for the draft decree closed on December 31, 2008. The Amended Consent Decree was entered into Federal Court on April 15, 2009. For this Facility Plan, the term "Consent Decree" will be understood to mean the Amended Consent Decree as it was entered into Federal Court on April, 15, 2009.

The IOAP is a major part of MSD's response to the Amended Consent Decree. The IOAP is a long-term plan to control CSOs and eliminate sanitary sewer overflows (SSOs) and other unauthorized discharges from MSD's sewerage system. Controlling CSOs is expected to improve water quality in both Beargrass Creek and the Ohio River through and below Jefferson County. The expected water quality benefits of CSO control include reductions in the peak levels of bacteria in the Ohio River and Beargrass Creek and a reduction in the amount of time that average bacteria levels exceed water quality standards. Eliminating



SSOs and other unauthorized discharges is similarly expected to reduce bacterial levels in the streams outside the CSS service area. In addition, CSO and SSO control will enhance public health and safety by reducing the potential for the public to come in contact with untreated sewer overflows, whether in the basements of their homes or in the streets and ground surfaces where sewer overflows currently discharge.

#### **ES.5.1.2 Long-Term Control Plan Benefits**

The suite of projects selected for the Final CSO Long-Term Control Plan (LTCP) portion of the IOAP will result in approximately 98 percent capture and treatment of wet weather combined sewage during an average year. This benefit represents an 89 percent reduction in CSO volume compared to conditions in 2008. As a point of reference, the presumptive approach for compliance with water quality standards in EPA's CSO Control Policy (EPA, 1994) is based on a minimum of 85 percent capture and treatment of wet weather combined sewage.

#### **ES.5.1.3 Sanitary Sewer Discharge Plan Benefits**

The suite of projects selected for the IOAP's Final Sanitary Sewer Discharge Plan for SSO control will result in the elimination of capacity-related SSOs up to the site-specific level of protection. The SSO projects are anticipated to eliminate an average of 145 SSO events per year (290 million gallons of overflow volume), based on 2005 to 2007 data normalized for rainfall. In terms of water quality, SSO projects eliminating approximately 100 tons of 5-day biochemical oxygen demand and approximately 200 tons of suspended solids annually.

#### **ES.5.1.4 Sustainable Performance**

MSD's IOAP is based on a "demonstration approach" to achieving compliance with the Consent Decree and the CWA requirements. While MSD is required to certify compliance with the CSO management requirements after completing the full suite of CSO projects in 2020, MSD's CSO management performance will continue to be monitored through the Morris Forman WQTC KPDES permit with performance standards consistent with the commitments of the IOAP. Similarly, the SSO elimination projects are required to be completed by the end of 2024. MSD's certification that the performance objectives have been met will mean that MSD's obligations under the Consent Decree have been discharged, but the requirements for continued operation of the system to avoid further SSOs will continue through the KPDES permits for the WQTCs that govern operation of all the collection and treatment facilities. The Consent Decree requirements do not go away with the completion of the IOAP projects; the enforcement mechanism for sewer overflow control changes from the Consent Decree to the respective KPDES permits.

#### **ES.5.1.5 Integrated Overflow Abatement Plan Impacts on the Capital Improvement Plan**

Over the first 5 to 9 years of the planning period, the wastewater service area recommended CIP is dominated by completing the major projects of the IOAP. The major CSO storage basins are scheduled to be completed by the end of Fiscal Year (FY) 2021, with the remainder of the SSO elimination projects scheduled to be completed by the end of FY2025. Completing the entire suite of CSO and SSO projects in



accordance with the IOAP schedule is required by the Consent Decree. Failure to complete a project on schedule could be considered a violation of the Consent Decree with consequences including stipulated penalties that range from \$1,000 per day to \$5,000 per day, increasing as the length of schedule deviation increases. A 1-year schedule deviation could result in stipulated penalties of almost \$1.5 million.

The remaining sections of this Executive Summary address the balance of the recommended CIP. These projects address needs in wastewater, stormwater, flood protection, and asset management infrastructure that have been deferred for the past 10 to 15 years as MSD's resources were focused on meeting the Consent Decree requirements.

#### **ES.5.1.6 Nine Minimum Controls**

The Nine Minimum Controls (NMC) Program (EPA, 1995) was initially developed as part of the CWA CSO Policy to address CSS best management practices (BMPs) that do not require significant construction. With the completion of the CSO portion of the IOAP in FY2021, the reporting requirements for the NMC Program shift to what is required through the Morris Forman WQTC KPDES permit. As part of the permit requirements, MSD must sustain a continued focus on protection of public health and safety by providing for the BMPs required by the NMCs to be integrated into MSD's long-term approach to managing CSOs. In order to ensure effective public notification of sewer overflows. Maximizing storage in the conveyance system and maintaining WQTC capacity, for example, are BMPs that will remain in place in perpetuity as conditions of the Morris Forman WQTC KPDES permit.

The 20-year CIP recommendation includes funding for the formal NMC Program that is reported on quarterly as part of the Consent Decree requirements. This NMC program reporting is assumed to switch to KPDES reporting following FY2021. Capital projects that help sustain the intent of the NMC requirement are included in the recommended CIP through the end of the planning period.

The most significant long-term NMC activities are the real-time control (RTC) system in the combined sewer collection system and the Morris Forman WQTC improvements, which are also a major component of the IOAP. The 20-year CIP recommendation provides annual funding for ongoing RTC rehabilitation and renewal to ensure proper operation of the RTC system, which is necessary for long-term sustained compliance with the CWA CSO Policy, CSO LTCP, and NMC requirements. RTC in-line storage makes up approximately 15 percent of the total CSO storage volume in MSD's CSS. By using the capacity of existing interceptor sewers, RTC provides this storage at a small fraction of the cost required to construct offline storage tanks.

Sustaining reliable treatment capability and capacity at the Morris Forman WQTC is critical to ensure proper wastewater treatment for water quality protection. This is a significant endeavor that has been underfunded since the most recent overall plant rehabilitation was completed in the early 2000s. A detailed condition assessment has been prepared for the Morris Forman WQTC liquid process treatment facilities. Periodic equipment replacements and major plant renovations were scheduled in 5-year intervals for the purpose of financial planning. Overall, the 20-year CIP recommendations include approximately \$85 million in rehabilitation and renewal projects over the first 5 years of the planning period, and over \$100 million (escalated for inflation) in scheduled renewal projects over the



subsequent 15 years. In order to protect public health, these rehabilitation and renewal projects are essential to maintaining reliable operation of the largest WQTC in MSD's system. Unfortunately, the 2015 failure of the Morris Forman WQTC high-yard electrical distribution center provided a catastrophic view of the consequences of deferring facility renewal and replacement. As power was lost from the main electrical feed for the treatment plant, flooding and extensive damage occurred at the plant. Wastewater was discharged that had not been treated to water quality standards. Ironically, the backup power supply for the final effluent pump station had been deferred and therefore was not in place to avoid costly damage to the plant.

The Facility Plan assumes there will be no major changes in the Morris Forman WQTC discharge requirements during the planning period, and therefore the existing plant will continue to operate as-is for the duration of the planning period, except for initial construction of facilities required for nutrient removal late in the planning period as noted herein.

For many years MSD has produced a high-quality soil conditioner called Louisville Green from the biosolids generated by the treatment plant. The condition of the Louisville Green production equipment (primarily the biosolids dryers and pellet processing equipment) is rapidly degrading because of the severe duty conditions experienced in processing the highly abrasive, dried biosolids product. MSD has, in the past, been able to sell all of the Louisville Green it could produce, thereby offsetting operating costs for the system. The current degraded condition of the equipment requires MSD to landfill dewatered biosolids when the capacity of the drying system is overwhelmed. MSD, under a separate initiative, is investigating short-term biosolids management solutions that may include increasing the amount of dewatered biosolids disposed of by landfill, turning over management of the dewatered biosolids to a third-party vendor, and/or replacing the drying system with an alternate technology approach. Recognizing that implementing a new biosolids management system will take several years, the 20-year CIP recommendation includes short-term fixes for the dryer system, and expansion of the dewatered cake handling system to allow increased landfilling as continued operation of the dryers becomes impractical.

A 50-year look at continued operations of the Morris Forman WQTC at the current site has concluded that major changes in discharge standards (addition of nutrient or microconstituent removal) will likely require changes to both the liquid treatment and biosolids handling approaches. Given the severe constraints of the existing site, it will be necessary to locate new facilities on property not part of the current Morris Forman WQTC site. The long-term plan is being developed, and a phasing roadmap for systematic facilities expansion will be included. It is assumed that some level of nutrient removal may be required toward the end of the 20-year planning period. The 20-year CIP recommendation includes funds for land purchase and the start of facility construction to address nutrient removal during years 15 to 20 of the planning period. Treatment for microconstituents is not envisioned in the recommended 20-year CIP, but will represent a significant capital expense when required by new regulations.

#### **ES.5.1.7 Capacity, Management, Operations, and Maintenance**

The next largest program within the wastewater service area is the CMOM Program. This includes general best practice management approaches for MSD wastewater assets, including both the CSS service area and the separate sanitary sewer service area. EPA Region 4 developed the initial program



that became CMOM, and MSD's Consent Decree specifically requires the development and implementation of a CMOM Program. The intent of the CMOM Program is to ensure that BMPs are implemented across the utility, thereby increasing the ability of the utility to meet its obligations under the CWA. CMOM activities represent BMPs for wastewater utilities and will be sustained for the entire 20-year planning period.

Major components of the recommended CMOM Program include projects for major renewal and replacement projects at the Hite Creek, Floyds Fork, Cedar Creek, and Derek R. Guthrie WQTCs. These renewal and replacement projects are scheduled at 5-year intervals for each of the centers to ensure that MSD can maintain efficient and effective wastewater treatment, a critical aspect of public health protection. The budget recommended for each center is the result of an asset inventory and condition assessment of each WQTC. The actual scope of each project will be established during detailed design.

The CMOM Program provides proactive asset management of the pipes and pump stations that make up most of MSD's collection system. Budgets are recommended to provide inventory of critical parts for pump stations, rehabilitate and replace sewers that are leaking or in danger of structural failure, and provide standby generators in more locations to improve reliability during power outages. A project with "seed money" to initiate a private property inflow/infiltration (I/I) reduction project is also recommended in the CMOM budget. The private property I/I Program is expected to become self-sustaining through new fees after initial startup.

A significant addition to the CMOM Program is the expansion of the sewer rehabilitation and replacement activities to encompass major interceptors. In the past, MSD deferred major rehabilitation of these major interceptors because of the cost and difficulty in completing construction on these pipes. An increasing frequency of major interceptor failures indicates a critical need to proactively inspect and rehabilitate or replace these high-risk very old assets. When a major interceptor fails, a ripple effect is created across a much broader area because of road closures, traffic impacts, and other factors that directly impact the community. Since major interceptor rehabilitation projects have not been specifically identified at this time, an allowance has been created to begin the process of inspection, project development, and early-action remediation of high-risk defects over the next 5 years. By the end of 5 years, the allowance is increased to \$10 million per year and is completely focused on major interceptor rehabilitation and replacement. At this sustained funding level, MSD will be able to renew these critical assets on a prioritized basis. Preemptive rehabilitation is much less expensive than making emergency repairs, such as those MSD had to complete in response to a collapsed section of the Broadway Interceptor in 2015. This one repair interrupted businesses and severely impacted traffic flow on a main arterial roadway.

#### **ES.5.1.8 Capacity Development**

The recommended 20-year CIP budget also includes capacity expansions for the Hite Creek, Floyds Fork, and Cedar Creek WQTCs. The timing of these expansion projects has been based on population projections for each service area. Ensuring that capacity is available in advance of development supports growth and development for the community by avoiding moratoriums due to the rated capacity of the WQTCs being exceeded. This expansion is in accordance with KDEP regulations. The Derek R. Guthrie

and Morris Forman WQTCs are not anticipated to need a growth-related capacity expansion within the 20-year planning period; however, they will require investment to continue operating properly.

In addition to WQTC capacity, the recommended 20-year CIP also addresses conveyance system capacity needs. Projects are included to address areas anticipated to have significant growth in the Floyds Fork and Cedar Creek WQTCs service areas due in part to the development of the Parklands of Floyds Fork. Growth is also provided for in the Hite Creek and Derek R. Guthrie WQTCs service areas. The Morris Forman WQTC service area is essentially built-out, meaning growth will result from customers coming online through infill of existing developed areas. In addition to expansion of the sewer system, capacity issues with pump stations have also been identified and addressed. Several pump stations have been identified that do not have adequate capacity to meet projected peak flows because of future growth. To avoid the creation of new SSOs, these pump stations must be expanded in advance of the upstream collection system expansions that will bring them additional flow. The intent is to provide the needed reliable capacity in both the gravity and pumped portions of the collection system so that building moratoriums can be avoided.

#### **ES.5.1.9 Regulations**

The recommended CIP budget also includes future projects in anticipation of regulatory changes. Increased levels of treatment for nutrients (nitrogen and phosphorus) could be imposed before the end of the planning period. Projects to begin addressing nutrient removal requirements at each of the WQTCs are included in the latter years of the planning period. The timing of nutrient removal regulations probably depends on developing a Mississippi River watershed approach to addressing the issue of hypoxia in the Gulf of Mexico. Developing a comprehensive approach to the entire watershed is assumed to govern when these projects are actually implemented.

The removal of microconstituents has also been identified as a potential future regulatory requirement. While the imposition of standards requiring removal of microconstituents is not anticipated with the 20-year planning window, concepts have been developed and placeholder budgets recommended to address this potential future need. These placeholder budgets are not in the recommended 20-year CIP. The timing of microconstituent removal regulations will govern when these projects are actually implemented.

#### **ES.5.2 Volume 3—Stormwater and Drainage**

Stormwater management is a vital component of MSD's system, as it directly impacts the health and safety of Louisville residents. The recommended 20-year CIP includes a number of programs related to drainage and internal floodplain management. In 1987 the City of Louisville, through a Memorandum of Agreement, delegated MSD with responsible charge for stormwater management and Ohio River flood protection for most of Jefferson County. In 1988, MSD completed a Stormwater Drainage Master Plan that addressed the pre-existing backlog of known drainage and flooding problems and planned for improvements in overall drainage and flood protection for the service area. MSD began implementing the recommendations of the Stormwater Master Drainage Plan on a prioritized basis, within the budget limitations imposed by the insufficient revenue generated through drainage fees. The flood of 1997



diverted the focus of stormwater management to deal with specific vulnerabilities exposed by that severe flooding event. In 2003, MSD developed the Drainage Response Initiative (Project DRI) to address specific customer complaints primarily dealing with standing water on their property by providing “grade to drain” positive drainage. After the City/County merger of 2009, MSD added the unincorporated portion of Jefferson County to MSD’s stormwater management responsibilities. Notably, four communities in Jefferson County own and operate the stormwater drainage systems within their jurisdiction and are not part of MSD’s stormwater management and drainage system.

### **ES.5.2.1 Drainage**

#### LOCALIZED DRAINAGE ISSUES

Drainage problems create health and safety impacts for citizens directly at their homes, schools, businesses, and transportation routes. Beginning in 2003, MSD initiated an aggressive program, Project DRI, to address a wide variety of drainage issues customers pointed out. The program assigned experienced project managers, contractors, and inspectors to address drainage problems on a “grade-to-drain” basis. Efforts under this program address problems ranging from structural flooding to alleviating minor standing water problems. Since 2003, most of the funds available through drainage fees have been allocated to Project DRI. MSD has spent more than \$125 million in capital drainage improvements through Project DRI. This has been a very valuable program for MSD’s customers, and the recommended 20-year CIP includes an annual allocation of \$2.8 to \$5 million per year to sustain Project DRI.

#### STORMWATER MASTER PLAN

Given the public concern over the effects of the increased frequency of extreme storms, the small-scale drainage solutions offered by Project DRI need to be supplemented with a program to address issues of stormwater management and flood protection on a watershed basis. A significant increase in spending for stormwater management and flood protection is recommended to increase public health and safety protection for citizens across the entire service area.

Based on the reviews of stormwater planning documentation, only countywide stormwater planning done in the past 30 years was related to internal (that is, not related to the Ohio River) floodplain management. MSD has completed studies in several watersheds to update the definition of the Federal Emergency Management Agency (FEMA) and Local Regulatory Floodplains. These studies rely on FEMA-approved rainfall IDF information. These IDF curves were developed based on historical observations, and do not reflect conditions projected for 2035. Since the conditions projected for 2035 are not based on observed data, the updated floodplain information should not be used for regulatory purposes, but can be used to inform potential property owners of the risks associated with future extreme storm events.

While MSD requires plans for new development to document no adverse impacts on downstream flooding, the cumulative effects of land use changes within the existing developed areas have not always been subject to the same level of scrutiny. Some hydrology and hydraulic models used for drainage



planning have not been updated to reflect land use changes that have occurred since the late 1990s, and are not available in a countywide integrated database to allow identification of potential downstream impacts of new projects.

A comprehensive, countywide Stormwater Master Plan is recommended to be initiated as one of the first recommendations from the stormwater portion of the Facility Plan. This plan should address floodplain management definition and non-floodplain-related drainage problems in an integrated approach to deal with this highly visible MSD service.

#### EARLY ACTION PROJECTS

While the Stormwater Master Plan is being developed, MSD's customers expect immediate action to begin addressing stormwater issues. MSD and the Facility Plan Team have identified 10 areas across the county with a history of localized flooding problems not directly related to floodplain management issues. Potential drainage-based project concepts have been developed to protect these 10 areas to the 10-percent probability rain event, using storms projected for 2035 conditions.

#### STORMWATER MASTER PLAN IMPLEMENTATION

Allowances have been recommended in the 20-year CIP to provide for implementation of the Stormwater Master Plan. The recommended budgeted amounts were identified through extrapolation of Early Action Plan projects to the entire county. The intent is to provide the county with updated and expanded stormwater management facilities to consistently provide protection from the 10-percent probability storm event, using stormwater IDF targets projected for the end of the planning period. The funding required to do this is anticipated to exceed \$600 million over the 20-year planning period. MSD and the Facility Plan Team determined that it was critical to establish reasonable placeholder numbers in the long-range financial plan to be developed as part of the Facility Plan. This level of funding is recommended to allow MSD to provide a stormwater drainage protection for the 10-percent probability storm to the entire service area over the next 20 years.

#### VIADUCT FLOODING

MSD is responsible for drainage from 32 viaducts that are subject to flooding during storm events. Some viaducts become completely impassable in relatively minor storms. Viaduct flooding disrupts transportation routes, and has the potential for serious safety concerns if flooded roads are not barricaded in a timely manner, or drivers ignore the barricades and drive under the viaducts anyway. There are many instances of this occurrence in Louisville every year. The Facility Plan Team identified conceptual drainage solutions for each of the viaducts for which MSD is responsible. The projects were prioritized based on the team's understanding of traffic load and perceived risk to public health and safety. The project schedule will be further refined as part of the review and revision of the recommended 20-year CIP, in response to MSD's comments. Viaducts are a shared responsibility with Louisville Metro Public Works and the Kentucky Transportation Cabinet. Prior to initiating a costly

viaduct drainage solution, all parties should engage in determining the best approach to improving public safety at the viaduct locations.

#### **ES.5.2.2 Stormwater Quality (Municipal Separate Storm Sewer System)**

The purpose of the MS4 stormwater quality program is to improve stormwater runoff quality in Jefferson County and to protect the public health, safety, and welfare by reducing the introduction of harmful materials into the MS4 that discharge into the streams of our community. The MS4 permit outlines the regulatory requirements for discharging municipal stormwater into local water bodies. Following are some major categories for program compliance:

- Public education and outreach
- Management of industrial facilities
- Stormwater pollution prevention plan creation and oversight
- Administration of construction site management
- Post construction controls (green infrastructure)
- Maintenance and analysis of water quality monitoring equipment and data

The current 5-year MS4 permit cycle began on August 1, 2011. The permit establishes the Maximum Extent Practicable (MEP) effort for MS4 programs to maintain MSD compliance with the Clean Water Act.

MSD uses green infrastructure techniques such as infiltration, rain gardens, and basin retrofits to offset the need and costs on conventional facilities such as storage basins. This has proven to effectively reduce volume in the CSS, and for water quality improvements for treatment of runoff in MS4 areas. There are requirements for new construction to include these types of practices to control the 80th percentile event (0.6 inch of rain) in Louisville Metro. MSD funding is available for construction cost offsets in the CSS area and potential stormwater fee credits in the MS4 areas. Funding commitments for this program were defined in the IOAP, and have been retained in the Facility Plan recommended CIP.

The Facility Plan identified a number of large stormwater retention basins with the potential for conversion of all or part of the basin to provide infiltration of stormwater. These projects are identified to be completed within the first 10 years of the recommended CIP, providing very cost-effective green infrastructure solutions on a large scale.

#### **ES.5.2.3 Floodplain Management—Flood Response Fund**

MSD has purchased approximately 200 homes through federal grant programs since the 1997 flood, and is currently working on eight open grant projects to purchase additional homes located in flood-prone areas. MSD also has 13 grant applications under review by FEMA. These grant applications include an additional 58 flood-prone properties that could be mitigated through acquisition. Most of these grants require state and MSD cost-sharing participation.

Following a number of extreme storm events in 2015, the Mayor formed a multiagency Flood Mitigation Workgroup to address impacted residents who were unable, for a variety of reasons, to get back in their

homes after the flood waters receded. The Flood Mitigation Workgroup recommended a number of mitigation approaches including establishment of a “quick-buy” program to allow property owners to sell flood-impacted property in a much shorter time than would typically be possible. The MSD Board approved allocation of \$1.5 million from the FY2016 budget to fund this program. The Flood Mitigation Workgroup recommended an annual fund be established to provide timely relief to property owners impacted by future extreme storm events.

The Flood Response Fund proved to be a vital part of the community’s recovery after the 2015 floods. The recommended 20-year CIP includes an annual allocation of \$4 million per year to the Flood Response Fund for various flood mitigation and response activities including continuing the quick-buy program where appropriate; implementing small-scale flood protection projects; and applying for, administering, and providing local-share funding for FEMA and other flood relief grant programs.

### **ES.5.3 Volume 4—Ohio River Flood Protection System**

In 1987 the City of Louisville, through a Memorandum of Agreement, delegated MSD with responsible charge for the Ohio River Flood Protection System (ORFPS) serving Jefferson County, at the same time the stormwater drainage system became part of MSD’s responsibilities. No separate revenue source was established for this service, so capital and operating expenses for the ORFPS are funded out of drainage fees.

The ORFPS is critical to protecting Louisville and Jefferson County from the type of devastating flooding experienced in New Orleans following Hurricane Katrina, and along the Mississippi River when flood levee and pump station systems also failed during the extreme high water conditions experienced in the past decade. Louisville’s ORFPS underwent a Levee Safety Evaluation (LSE) by the U.S. Army Corps of Engineers (USACE) in 2015 and found to be compliant with the level of protection required by FEMA. The level of Ohio River flood protection required by FEMA incorporates a “coincident frequency analysis” that statistically determines the probability of a rain event happening at the same time as high Ohio River levels. The coincident frequency analysis found the MSD Ohio River flood protection systems is adequately sized to handle a 1 percent probability (100-year storm) event. The FEMA criteria are not related to MSD’s local design criteria, which call for conveyance (pumps and pipes) to be sized for at least the 10 percent event. While meeting the 1 percent criteria in a coincident frequency analysis, several of the flood pumping stations require significant expansion to comply with drainage-related design criteria. The LSE contained information about minor deficiencies that need to be corrected and are included in the recommended 20-year CIP.

#### **ES.5.3.1 Flood Pumping Stations**

Much of the ORFPS was constructed in the 1950s. Design criteria that could be located from records of this era usually indicated the flood pumping stations were intended to pump the 10 percent probability storm (that is, a 10-year storm), as defined by 1950 land use patterns and pre-1950 rainfall statistics. Some of the design documents recommended that the capacity requirements be updated at 10-year intervals to account for land use changes, among other things. To our knowledge, prior to the 2015 LSE the capacity of these flood pumping stations has never been reassessed through comprehensive

hydraulic and hydrologic modeling. As noted previously, capacity assessment completed as part of the LSE identified several flood pumping stations that do not currently meet the 10-percent storm.

In addition to capacity concerns, many of the flood pumping stations have original 1950s vintage electrical and mechanical equipment. For the most part, the stations are manually operated using control systems that cannot be repaired with off-the-shelf components. To ensure the reliability and adequacy of the flood pumping station system, all pump stations were subject to a condition assessment (in addition to the USACE LSE assessment) and hydraulic and hydrologic modeling using storm IDF's projected for 2035. The recommended 20-year CIP includes rehabilitation and/or expansion of all 16 flood pumping stations in MSD's system. Given the size of these facilities, the costs are substantial but the risks being addressed are vital to Louisville's protection against catastrophic flooding.

#### **ES.5.3.2 Levee and Floodwall System**

MSD maintains a proactive maintenance program to assure the integrity of the levee and floodwall system, including numerous gates, road closures, and other floodwall and levee penetrations. In addition, USACE does a biannual inspection of the levee and floodwall, resulting in a report on any deficiencies noted. The recommended 20-year CIP includes continuation of a proactive preventive maintenance program, in addition to the corrective actions recommended by the LSE. These efforts are critical to protect the Louisville community from flooding.

#### **ES.5.4 Volume 5—Property**

In addition to the hundreds of pieces of property addressed in Volume 5, MSD owns a large inventory of aboveground facilities that support MSD's operation of wastewater, stormwater drainage, and Ohio River flood protection services.

##### **ES.5.4.1 Facilities**

The Facility Plan Team completed a condition assessment of over 200 buildings and recommended corrective actions where deficiencies were noted. The main areas of deficiency were in roofs. MSD has aboveground buildings with roofs all over the county, ranging from the large roof system at the Central Maintenance Facility to the roof over a small pump station building. Roofs appear to be the one area that MSD allows to "run to failure." Roofs are seldom replaced until a leak is detected inside the building. The Facility Plan recommends an extensive program of roof replacement in the first 5 years, using standardized roofing systems for different applications. Regular inspection and replacement before failure occurs is then recommended to provide the minimum cost of ownership for the buildings protected by these roofs.

The Facility Condition Assessments also identified a number of deficiencies in areas related to heating, ventilation, and air conditioning, building egress, signage and safety equipment, and indications of conditions that could eventually cause structural issues, and even structural failure. The proposed 20-year CIP includes projects to address the specific recommendations identified by the Facility Plan Team, with future budgets to complete periodic condition assessments following deficiency correction.



#### **ES.5.4.2 Capital Equipment**

MSD's support systems include assets other than property and facilities. As noted in Volume 1, Chapter 4, MSD owns or leases more than 600 vehicles and portable equipment, ranging from passenger vehicles and pick-up trucks, to large excavators and sewer cleaning trucks. MSD is investigating the potential for leasing more equipment, which would move the costs from capital to operating budgets. The specialty equipment used in MSD's operations and maintenance activities may not be available for lease, and MSD should continue to own them to be certain they are available any time they are required. The recommended 20-year CIP includes an annual allowance for equipment repair and replacement.

#### **ES.5.4.3 Information Technology Systems and Louisville and Jefferson County Information Consortium Support**

MSD also maintains an extensive inventory of IT hardware and software. This inventory is subject to periodic upgrade and replacement like all MSD's other assets. In addition, MSD hosts the LOJIC system that similarly requires periodic upgrades and replacements to hardware and software. The recommended 20-year CIP includes annual allowances to account for these anticipated future costs.

### **ES.6 FINANCE**

To implement a \$4.3 billion capital program and the associated costs to operate new facilities, MSD must have the funding to pay for it. Unlike the IOAP, which is required by Federal Consent Decree to be completed, most of the stormwater management and ORFPS projects developed in this Facility Plan are not specifically required by any specific regulation. Providing for infrastructure renewal and replacement and improving the consistent level of service in stormwater drainage and flood protection are local decisions driven by MSD's mission to provide safe and clean waterways for the community. MSD will implement this Facility Plan to the extent funding is provided through the rate-setting process. If sufficient funding is not provided to complete the recommended projects in the 20-year planning period, then some projects will be deferred to the future, as more funding comes available.

#### **ES.6.1 Revenue Requirements and Rates**

The MSD Board approves rates, rentals, and charges on an annual basis. The Board has the authority to raise rates up to 6.9 percent per year without Metro Council approval. Rate increase higher than 7 percent require Metro Council approval. The CIP recommended by the Facility Plan totals \$4.3 billion over 20 years. The recommended CIP for FY2017 to FY2021 exceeds \$1 billion. The revenue generated by current rates, increased at 7 percent per year or less will not generate enough revenue to support \$1 billion in capital spending over the next 5 years. If current rates are increased by no more than 6.9 percent per year for the next 5 years (\$3.60 per month for a typical customer in FY2018), then approximately \$480 million in capital projects will need to be deferred. While 6.9 percent per year rate increases may provide enough revenue to implement the entire Facility Plan recommended CIP over the 20-year planning period the recommended schedule cannot be achieved.



Completing the projects in the recommended CIP on the schedule recommended in the Facility Plan will require a 20 percent to 25 percent (\$10.50 to \$13.12 per month for a typical customer in FY2018) rate increase in FY2018, followed by rate increases up to 6.9 percent for the remaining years of the planning period. If a smaller rate increase is approved for FY2018, then the project schedule will need to be adjusted and recommended projects deferred to a later date based on MSD's resulting financial capabilities and project priorities identified by MSD staff. Projects directly related to Consent Decree or other regulatory requirements will receive the highest immediate priority. Projects of a lower priority will be deferred until the major IOAP projects have been completed and funds are available. The project prioritization system used to determine the recommended Facility Plan schedule is available for MSD staff to use in determining the priorities based on the information available at the time the budget revisions are made.

### **ES.6.2 Rate Projections**

Table 1.6-51, in Volume 1, Chapter 6, shows the projected rate increases required to fund implementation of the Facility Plan over the next 20 years. If the recommended project schedule is followed, then the most critical cash flow issues are found in FY2017 to FY2019.

### **ES.6.3 Rate Relief**

To avoid imposing additional stressors on the low-income population of our community, MSD is investigating the concept of meaningful rate relief for those in need. While most of MSD's customers spend less than 1 percent of their household income on wastewater and drainage services, almost 28 percent of MSD's customers spend more than 2 percent of their household income on these services, a threshold level even EPA considers a high burden on household budgets.

To help implement a low-income rate relief program, MSD has partnered with the Metro Department of Community Services, who currently administers the Low-income Home Energy Assistance Program (LiHEAP). Community Services has agreed in principle to administer a rate-relief program for MSD, based on the qualification standards used in LiHEAP. Subject to Board approval, MSD is considering a rate-relief subsidy between 20 and 40 percent for customers who qualify. It is anticipated that the current Low-income Senior Citizens Discount Program would be phased out, but seniors would be "grandfathered" into the new rate-relief program regardless of LiHEAP qualification standards.

## **ES.7 SUMMARY**

This Facility Plan represents MSD's most ambitious planning effort in a generation, and perhaps ever. The depth and breadth of the study and its recommendations provide a roadmap to fulfilling the community's wastewater, stormwater, and flood protection needs for the next two decades and the foundation for many more years of success. The integrated, prioritized CIP recommendation covers all service areas, sets a clear course for our community's future and can be the basis for MSD providing safe, clean waterways for our community.



## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 1 INTRODUCTION AND BACKGROUND

The Louisville and Jefferson County Metropolitan Sewer District (MSD) was created in 1946 as a public body corporate and subdivision of the Commonwealth of Kentucky. MSD is responsible for the sewer and drainage systems within the Louisville Metro area, which now comprise most of Jefferson County, Kentucky. These systems include 3,300 miles of wastewater collection sewer lines, and five regional water quality treatment centers (WQTCs). Chapter 76 of the *Kentucky Revised Statutes* authorizes MSD to construct improvements within its service area and to recover the cost of its services in accordance with the rate schedules adopted by its Board.

In 1987, MSD assumed responsibility for stormwater drainage and flood protection for most of the incorporated portions of Jefferson County from city and county government agencies and the U.S. Army Corps of Engineers (USACE). This new utility service provided Louisville and Jefferson County with the first comprehensive approach to resolving and abating drainage problems; MSD is responsible for the 376-square-mile stormwater drainage system. Also transferred to MSD was the responsibility for operating and maintaining the 29-mile Ohio River levee system, along with 16 flood pumping stations (FPSs). In October 2009, following the City/County merger, MSD extended the drainage service area to the Jefferson County boundary.

MSD has approximately 600 employees, whose mission is as follows: “Providing exceptional wastewater, drainage and flood protection services for the community,” with a vision of “Achieving clean, safe waterways for a healthy and vibrant community.”

#### 1.1 PURPOSE AND SCOPE

In November 2014, MSD initiated the 20-Year Comprehensive Facility Plan—Critical Repair and Reinvestment Plan (Facility Plan), which integrates recent engineering studies, planning documents, and other pertinent reports. The intent is to provide a consolidated plan that addresses the full range of MSD’s responsibilities (wastewater, stormwater, and flood protection). After reviewing existing planning documents, permits, and regulations, a gap analysis identified additional areas of study, conflicts between existing plans and current or future regulations, and opportunities for improving MSD’s financial standing, service levels, or environmental stewardship. A key part of the Facility Plan is developing a prioritization and optimization process to develop long-term capital and operating programs for each of MSD’s areas of responsibility.

The Facility Plan addresses the following five categories of MSD operations and responsibilities:

- Programmatic planning
- Wastewater collection and treatment
- Stormwater management, drainage, and internal floodplain management

- Ohio River Flood Protection
- Property and support facilities

Programmatic planning addressed common elements that apply to the other four categories of evaluation and assessment. Topics and issues addressed were the following:

- Recommended 20-year Capital Improvement Plan (CIP) (MSD, 2016)
- Levels of service
- Cost of service
- Rate study
- Regulatory forecasting
- Population trending

Wastewater topics and issues addressed were the following:

- Incorporating the *Integrated Overflow Abatement Plan* (IOAP; MSD, 2009)
- Incorporating the Capacity, Management, Operations, and Maintenance (CMOM) Program (MSD, 2006)
- Incorporating the *Sewer Overflow Response Protocol* (SORP; MSD, 2011)
- Incorporating the U.S. Environmental Protection Agency (EPA) Nine Minimum Controls (NMC) Program (EPA, 1995)
- Incorporating existing facility plan(s) and action plan(s)
- Incorporating existing system evaluations and facilities assessment
- Assessing pending and possible regulatory changes
- Evaluating asset performance and condition
- Evaluating utility resiliency to address challenges of the increased frequency of extreme storms
- Incorporating and potentially expanding the real-time control (RTC) system
- Evaluating alternative approaches to a private property inflow reduction program
- Assessing the needs for service to new customers in the unsewered areas in Jefferson County
- Assessing future treatment needs for growth and regulatory changes, including the potential for more stringent levels of nutrient removal
- Recommending backup power at critical facilities

Stormwater and drainage topics and issues addressed included the following:

- Evaluating existing major drainage systems
- Evaluating neighborhood drainage systems
- Incorporating green infrastructure in stormwater management

- Assessing permit requirements (current and potential future requirements) for the Municipal Separate Storm Sewer System (MS4) and the associated water quality impacts and improvements
- Evaluating interior county flood protection, including the existing floodplain management system, proposed flood mitigation measures, a public warning system, high hazard dams, and emergency evacuation plans
- Determining the impact of climate and rainfall atlas changes on design criteria and level of service
- Evaluating the impacts of extreme storms at the neighborhood and county levels

The flood protection portion of the Facility Plan addressed the following elements specific to the Ohio River Flood Protection System (ORFPS):

- Assessing level of protection
- Evaluating the need for FPS upgrades or rehabilitation
- Assessing the condition of the floodwall and existing programs for maintenance
- Assessing the condition of the levee system and existing programs for maintenance
- Evaluating the need for backup power at critical facilities
- Determining the potential impact of climate and rainfall atlas changes on level of service
- Assessing emergency contingency plans

The property and support facilities portion of the Facility Plan addressed the following:

- Evaluating existing MSD-owned properties and uses
- Reviewing energy use and conservation practices
- Evaluating current mowing practices and recommendations for future changes
- Evaluating future property/land needs
- Assessing condition and needs of existing MSD-owned buildings and facilities

In January 2014, the MSD Board adopted the *MSD Strategic Business Plan 2014-18* (MSD, 2014) that defined a change agenda for MSD. The intent of the Strategic Business Plan is to dramatically improve customer care and services; make appropriate investments in technology, infrastructure, and employees; and improve the quality of life in Louisville and Jefferson County, while maintaining the financial viability of the utility. This Facility Plan will be a key part in making the Strategic Business Plan a reality.

## **1.2 BOUNDARY CONDITIONS**

Beginning in 2003, MSD stepped up its attention to compliance with the Clean Water Act (CWA) and began a series of communications with EPA. In 2005, MSD entered into a Federal Consent Decree to



achieve regulatory compliance with the CWA. In 2009, the Consent Decree was amended,<sup>1</sup> including a series of action plans to reduce combined sewer overflows (CSOs) and eliminate sanitary sewer overflows (SSOs) by 2020 and 2024, respectively. In 2014, the IOAP was updated to improve compliance and adjust capital project schedules. For this Facility Plan, the IOAP was incorporated without repeating its analysis or reconsidering its action plans.

Background review and data gathering identified currently planned projects. Those projects already accepted by regulators were assumed to proceed to implementation. Decisions made to identify previously planned projects were assumed to be still valid, except when known population or flow increases required projects to increase in size, or a project was no longer applicable in its current planned state as a result of regulatory changes. In such cases, reevaluating the project became necessary.

The Facility Plan considers climate change as an issue related to utility resiliency and level of customer protection. The intention was to avoid a debate on the validity of climate change and focus on the ability of the MSD infrastructure to function under different storm patterns. Statistical data show that more rain is being received in fewer events (more severe, intense storms). Proposed and prospective regulations that could affect MSD's capital or operating programs in all service areas were also evaluated.

### **1.3 20-YEAR COMPREHENSIVE FACILITY PLAN REPORT ORGANIZATION**

This Facility Plan comprises five volumes, each detailing specific aspects of the planning process and final Facility Plan. The following sections brief describe the content of each volume.

#### **1.3.1 Volume 1—Programmatic and Integrating Information**

Volume 1 describes overarching, programmatic aspects that are common to each part of the Facility Plan, as well as the requirements, processes, and factors influencing Facility Plan development. This volume provides the roll-up of capital and operating program needs for the services that MSD provides (wastewater, stormwater, and Ohio River flood protection), in addition to the property and support facilities that allow MSD to provide the service required. This volume also presents a 20-year financial plan projection and alternative rate scenarios to finance the recommended CIP and operating program improvements that are identified in the other four volumes.

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<sup>1 1</sup> The Commonwealth of Kentucky, Plaintiff, and the United States of American, Plaintiff-Intervener, v. Louisville and Jefferson County Metropolitan Sewer District, Defendant, in the United States District Court, Western District of Kentucky, Louisville Division. Amended Consent Decree, Case 3-08-cv-00608-CRS. Filed April 15, 2009. Available at <http://www.msdpjprojectwin.org/Portals/0/Library/Consent%20Decree/Agreement/Commonwealth%20of%20KY%20vs%20MSD%20%20Amended%20Consent%20Decree.pdf>.



### **1.3.2 Volume 2—Wastewater Collection and Treatment**

Volume 2 addresses MSD’s wastewater system, which extends throughout much of the developed portions of Jefferson County. This volume includes approximately 600 miles of combined sewers (which carry sanitary wastewater during dry weather and a combination of stormwater and sanitary wastewater during wet periods), 2,700 miles of sanitary sewers, more than 260 pumping stations, five regional WQTCs, and an estimated 1,400 miles of lateral connections to buildings. The wastewater system is being rehabilitated, renewed, and expanded to address the sewer overflow control requirements of MSD’s Consent Decree. In addition, major components of MSD’s wastewater collection system are aging, with some more than 100 years old. The challenge of dealing with this aging infrastructure is a major driver for project development under this Facility Plan.

### **1.3.3 Volume 3—Stormwater and Drainage**

Volume 3 focuses on interior stormwater and drainage infrastructure, and it includes localized stormwater drainage systems, interior (inside the ORFPS) floodplain management, and water quality issues related to the MS4 Program. The increased frequency of extreme storms has severely stressed this system across the county, resulting in a call for increased levels of stormwater drainage protection. The stormwater system’s inability to properly respond to emerging precipitation trends threatens property and public health and safety.

### **1.3.4 Volume 4—Ohio River Flood Protection System**

Volume 4 addresses the ORFPS, consisting of 29.5 miles of floodwalls and levees that protect the Louisville Metro area from flooding on the Ohio River and 16 FPSs that lift drainage from the ORFPS interior over the floodwalls and levees when the Ohio River is at flood stage. Although this system has exhibited a very high degree of reliability since the first components were constructed in the 1950s, the age and critical nature of this system require rehabilitation and renewal if reliable operation is to continue in the future. In addition, land use changes and changing precipitation patterns indicate that some of the FPSs should be expanded to provide a consistent level of protection to the portions of the county protected by these systems.

### **1.3.5 Volume 5—Property**

Volume 5 is focused on the hundreds of facilities and properties that MSD owns and operates throughout the Louisville Metro area, from small pump station enclosures to the former shopping center turned Central Maintenance Facility (CMF). Each property comprises dozens of systems and components, each of which requires ongoing inspection, review, and maintenance to ensure that past investments are fully realized. This volume will discuss efforts to catalog and evaluate current facilities and properties, develop future property and facility needs, review current mowing efforts, and recommend energy conservation efforts across all facilities.

## **VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION**

### **CHAPTER 2 COMMUNICATIONS AND OUTREACH**

The Facility Plan Communications and Outreach Program was conducted in two distinct phases. The first phase, during plan development, focused on obtaining internal and external stakeholder input on the problems and the potential solutions. This effort supported development of the draft Facility Plan.

The second phase was referred to as the “Community Conversation, which dealt primarily with the community’s preferences on the timing of starting activities deemed critical by the Facility Plan Team, before the Amended Consent Decree (ACD) projects were complete. Given the scope and projected cost of the recommended projects and programs, starting on some of the critical activities before ACD projects were completed was projected to significantly impact rates. MSD, supported by the Facility Plan Team, undertook this second phase of communications and outreach to facilitate a two-way dialogue between a broad audience of internal and external stakeholders primarily focused on implementation issues.

#### **2.1 STAKEHOLDER GROUPS**

The scope and scale of the Facility Plan requires support from the community and entire MSD organization to be successful. To this end, stakeholder groups were formed from MSD staff and the community. Understanding that the role of employee stakeholders differs from that of the general public stakeholders, groups were divided into internal and external stakeholders so that the message and information could be tailored to their specific interests.

##### **2.1.1 Internal**

An outreach program was implemented to obtain input from a broad range of MSD staff and other internal stakeholders. Periodic technical workshops related to each of the four service areas (Ohio River flood protection, wastewater, property, and stormwater and drainage) were conducted with MSD staff. A monthly project managers’ and project coordination meeting was held with MSD management personnel throughout 2015 and 2016, until the draft Facility Plan was delivered. In 2017, almost 600 of MSD’s staff participated in community conversation workshops to learn about the Facility Plan and provide input on implementation issues.

##### **2.1.1.1 Board Meetings and Committees**

Regular updates were given to MSD’s Board and committees throughout Facility Plan development. The Board Infrastructure Committee received detailed updates and provided guidance on the Facility Plan approach and development. Progress and findings reports were delivered by MSD staff and/or the Facility Plan consultant manager at key points throughout the project. Board members were informed of the overall Facility Plan format, the plan to complete it, the scope of work, findings, and prioritization process for recommended projects. The continued interaction with the Board was a key component of

their endorsement of the Facility Plan recommendations and the associated financial requirements to implement it. Regular communications with the Board and its committees continued through the 2017 community conversation—both about the details of the plan and about the findings of the various community conversation outreach activities.

### 2.1.1.2 Technical Workshops

Internal technical workshops provided input on the form, format, and proposed content of the values-based performance metrics to be used in the risk management approach to accomplish the following:

- Determine project benefits
- Review the final draft project evaluation and prioritization toolset
- Review the preliminary prioritization of the consolidated project list
- Review the draft of the final Facility Plan

Workshops were organized and the topics targeted the specific need of each MSD service area (wastewater, stormwater and drainage, and flood protection), and property/facilities considerations.

#### WASTEWATER COLLECTION AND TREATMENT

Four technical workshops were conducted with MSD wastewater and technical services staff. The topics covered at each workshop are identified in Table 1.2-1. Workshop agendas, meeting minutes, presentations and handouts, and participant lists are included in Appendix 1A.

**Table 1.2-1. Wastewater Collection and Treatment Technical Workshops**

Workshop Number	Date	Topics Covered
1	March 6, 2015	Project scope and approach, background data review, regulatory requirements, private property infiltration and inflow (I/I)
2	July 20, 2015	Regulatory forecast, operational program review, private property I/I, asset performance and regulatory compliance, condition assessment of wastewater infrastructure, utility resiliency, project prioritization approach, and stakeholder engagement
3	December 11, 2015	Asset performance and regulatory compliance, conditions assessment, utility resiliency, microconstituent planning, flow projections, Morris Forman WQTC 50-year visioning
4	June 3, 2016	Minimum capacities, level of service considerations, WQTC site space planning, project prioritization approach, draft CIP, Morris Forman WQTC 50-year visioning

STORMWATER AND DRAINAGE

Four technical workshops were conducted with MSD’s stormwater and technical staff. Topics covered at each workshop are identified in Table 1.2-2. Workshop agendas, meeting minutes, presentations and handouts, and participant lists are included in Appendix 1B.

**Table 1.2-2. Stormwater and Drainage Technical Workshops**

Workshop Number	Date	Topics Covered
1	February 9, 2015	Overview of the stormwater service area scope and specific topics to be addressed, progress of initial data gathering, and review of background reports
2	August 26, 2015	Impacts of intense rain events in the first half of 2015, near-term measures to address issues, Facility Plan efforts to address recent experiences
3	April 5, 2016	Extreme storm evaluation on the six study areas, planning-level solutions for managing extreme storms, and preliminary impact on the county
4	August 2, 2016	Extreme storm evaluation update on the costs to provide an updated 10-year storm level of service across the county

OHIO RIVER FLOOD PROTECTION SYSTEM

Four technical workshops were conducted with MSD flood protection system and engineering staff to obtain input at key points during the facility planning process. Table 1.2-3 lists topics covered at each flood protection workshop. Workshop agendas, meeting minutes, presentations and handouts, and participant lists are included in Appendix 1C. In addition to hosting the structured workshops, the Facility Plan Team met onsite with flood protection system staff at every flood pump station, and conducted a joint condition assessment and discussion of each station’s rehabilitation and renewal needs.

PROPERTY

Three technical workshops were conducted with various MSD staff groups to discuss MSD-owned properties and facilities (Table 1.2-3). The agenda for each meeting was similar and the following topics were considered:

- Overview of the property and facilities service area scope
- Overview of the planned facility condition assessment
- Identification of items of concern
- Review of available, past or planned, future facility improvements documentation

- Development of a list of specific facilities to be evaluated and identification of MSD points of contact

The subject area of each property and facilities workshop is identified in Table 1.2-4. Workshop agendas, meeting minutes, presentations and handouts, and participant lists are included in Appendix 1D.

**Table 1.2-3. Flood Protection System Technical Workshops**

Workshop Number	Date	Topics Covered
1	February 3, 2015	Overview of flood protection system service area scope of work, data gathering and review of background documents
2	January 27, 2016	Status of flood protection system deliverables, regulatory forecast, evaluation of the FPS power supply grid, condition assessment (pumping stations, floodwall, and levee), flood protection system capacity and performance, storm atlas and climate change impacts, levels of service to be evaluated, and results of gap analysis
3	March 3, 2016	Prioritization process and preliminary results of project scheduling
4	June 28, 2016	Results of the prioritization process, alternative evaluations for recommended projects, and integration of staff feedback on project schedules

**Table 1.2-4. Property and Facilities Technical Workshops**

Workshop Number	Date	Subject Area of Workshop
1	February 19, 2015	Pump station operations, RTC facilities, regional WQTC facilities, Morris Forman WQTC
2	February 20, 2015	FPSs and stormwater pump station facilities
3	February 20, 2015	Main office and central maintenance facilities

### 2.1.1.3 Project Managers and Project Coordination Meetings

In 2015 and 2016, the Facility Plan Team project management staff met monthly with MSD’s project management team. The meeting agenda routinely consisted involved reviewing project status, including identifying deliverables completed during the preceding month, reviewing the consultant’s monthly invoice, discussing project-related issues, and identifying action items. The project management meeting participants are listed in Table 1.2-5. During 2017, the technical aspects of the Facility Plan were

largely suspended during the MSD and public review process; project. Project management meetings were similarly suspended. In lieu of project management meetings, MSD initiated weekly meetings focused on the communication and outreach program—referred to as the community conversation. Facility Plan Team members attended these meetings and supported the community conversation efforts, providing information on the recommendations of the Facility Plan, which the community conversation team then “repackaged” into more stakeholder-focused messages.

**Table 1.2-5. Project Managers and Project Coordination Meeting Participants**

Name	Organization/Title
Julie Buckler	MSD, Facility Plan Assistant Project Manager
Stephanie Laughlin	MSD, Facility Plan Project Manager
John Loechle	MSD, Engineering Director
Paul Maron	Strand Associates, Consultant Team Deputy Project Manager
Wolffie Miller	MSD, Infrastructure Planning
Gary Swanson	CH2M HILL, Consultant Team Project Manager

### **2.1.2 Wet Weather Team**

In 2006, MSD chartered a Wet Weather Team (WWT), comprising MSD staff and consultants, with community representatives serving as the stakeholder group. The initial WWT mission was directly related to MSD’s response to the 2005 Consent Decree, which addressed sewer overflow issues. MSD’s response, known as the IOAP, required input from the public. The Consent Decree stated that the WWT “will prepare a plan for funding the program, and will develop a program for public information, education and involvement.” MSD subsequently expanded the role of the WWT Stakeholder Group to assist in developing a framework for decision-making that includes considering community values, priorities, and level of service in determining community investments required. A wide variety of community stakeholders were assembled to participate extensively in IOAP development. Although initially slated to disband in 2008, the WWT Stakeholders Group continued to meet and receive updates on IOAP implementation progress. During late 2014, the group’s focus was transitioned to also provide input to MSD’s Facility Plan. The following WWT Stakeholder Group objectives during Facility Plan development were defined during the initial WWT meeting in December 2014:

- Validate programmatic and project-specific values
- Review project-specific performance measures
- Confirm application of benefit scoring to alternative evaluation and prioritization
- Review preliminary suite of recommended projects
- Assist with public outreach development

### 2.1.2.1 List of Participants

The WWT Stakeholder Group members are recognized as community opinion leaders associated with diverse interest groups, including environmental advocacy, business and industry, elected officials, local government, community neighborhood, recreation, public health, environmental justice, and organized labor interests. As noted earlier, the WWT Stakeholder Group was formed as part of IOAP development, and the team was asked to stay engaged as a group to assist with the Facility Plan. While most of the original group is still actively participating, several members had to leave the WWT. When members leave, they are not automatically replaced with another member from their particular organization or affiliation. Instead, a new member is selected to represent a similar interest or will bring similar knowledge and/or expertise to the team. No organization (besides MSD) has a permanent seat on the WWT. Additional members were added to the WWT Stakeholder Group when it transitioned to supporting the Facility Plan to improve connections to different parts of the community that may be especially affected by the results of the Facility Plan. This dedicated and diverse complement of personnel, community representatives, and local officials participating in the WWT Stakeholder Group are listed in Table 1.2-6.

**Table 1.2-6. Wet Weather Team Membership (as of November 1, 2016)**

Member	Organization	Participation
Stakeholder Representatives		
Steve Barger	Small business owner, labor (retired)	2006 to present
Susan Barto	Mayor of Lyndon	2006 to present
Deborah Belitski	Louisville Metro Government, Director of Develop Louisville	2016 to present
Stuart Benson	Louisville Metro Council, District 20	2006 to present
Allan Dittmer	University of Louisville, Professor Emeritus	2006 to present
Billy Doelker	Key Homes LLC; Building Industry Association	2016 to present
Mark French	University of Louisville, Speed School of Engineering	2015 to present
Arnita Gadson	West Jefferson County Community Task Force	2006 to present
Mike Heitz	Louisville Metro Parks Department, former Director (retired)	2006 to 2015
Tom Herman	Zeon Chemicals (retired)	2006 to present
David James	Louisville Metro Council, District 6	2014 to present
Rick Johnstone	Deputy Mayor, Louisville Metro Mayor's Office (retired)	2006 to present
Maria Koetter	Louisville Metro Government, Director of Sustainability	2015 to present
Bob Marrett	CMB Development Company, LLC	2006 to 2016

**Table 1.2-6. Wet Weather Team Membership (as of November 1, 2016)**

Member	Organization	Participation
Kurt Mason	USDA Natural Resources Conservation Service	2006 to present
Jim Mims	Louisville Metro Planning & Design Services Department (through September 2015)	2014 to 2016
Gina O'Brien	Louisville Metro Government, Director of Brightside	2015 to present
Rocky Pusateri	Elite Built Homes	2016 to present
Lisa Santos	Irish Hill Neighborhood Association	2006 to present
Bruce Scott	Kentucky Waterways Alliance (retired)	2006 to present
Marty Storch	Louisville Metro Parks Department	2016 to present
David Tollerud	University of Louisville, School of Public Health & Information Sciences (retired)	2006 to present
Tina Ward-Pugh	WaterStep; former Louisville Metro Council – District 9	2006 to present
David Wicks	Get Outdoors KY; Jefferson County Public Schools (retired)	2006 to present
Louisville and Jefferson County Metropolitan Sewer District Personnel		
Angela Akridge	Chief Engineer	2006 to present
Brian Bingham	Chief of Operations	2006 to present
Steve Emly	Chief of Engineering (through May 2015)	2011 to 2015
Greg Heitzman	Executive Director (through August 2015)	2012 to 2015
John Loechle	Engineering Director	2015 to current
Tony Parrott	Executive Director	2015 to present
Technical Support		
Paul Maron	Strand Associates	2014 to present
Gary Swanson	CH2M HILL	2006 to present
Facilitation Support (not part of the WWT)		
Clay Kelly	Strand Associates	2014 to present

### **2.1.2.2 Rules of Engagement**

The members of the WWT Stakeholder Group do not formally represent their specific affiliated organizations, but they were asked to provide input that reflects the broad interest area of which they are experts and leaders. The charter was clear that the values-based risk management process supported by third-party facilitation would be employed to obtain input from the WWT Stakeholder Group for developing the Facility Plan.

### **2.1.2.3 Consensus-Seeking Process**

The WWT helped develop a structured values-based decision-making process that allowed for the systematic consideration of potentially competing values, as they related to technical and management options. The WWT process was completely open and consensus-seeking. The WWT Stakeholder Group was the backbone of the public participation process. All WWT stakeholders were expected to do the following:

- Participate fully and honestly in meetings, act in good faith, and strive for consensus
- Reach out to constituencies whose interests they reflect and, as appropriate, to other stakeholders to communicate about the project status and gather input and ideas for the projects
- Participate in the identification, review, and analysis of options

### **2.1.2.4 Approach to Meetings and Use of Facilitator and Consultants**

The WWT Stakeholder Group met regularly, generally each quarter, for a total of ten meetings between December 2014 and December 2016. These ten meetings included IOAP updates and specific topics related to Facility Plan development. Each meeting had a set agenda that included presentations by MSD, the technical team, and the facilitator. The content of these presentations included the most recent developments and progress on Facility Plan service areas, rate issues, and other relevant topics. Each meeting allowed the WWT Stakeholder Group to engage each other in discussion and pose questions and issues to MSD and the Facility Plan Team.

All meetings were open to the public and attended at various times by MSD staff and contractors, neighborhood representatives, and other interested parties. These guests or observers were allowed to observe the WWT Stakeholder Group meeting and provide comments at designated times. In general, the meeting format was as follows:

- Agenda, meeting objectives, and ground rules
- Updates and announcements from MSD and WWT Stakeholder Group
- IOAP update and implementation progress
- Specific discussion and presentations consistent with Facility Plan development objectives
- Observer comments and wrap-up

WWT meeting summaries, presentations, handouts, and documents are posted on the Project WIN website ([www.msprojectwin.org](http://www.msprojectwin.org)) in the WWT document repository. Documents are named and organized consistent with the WWT meeting in which the document was provided to the WWT. Appendix 1E of this volume includes a copy of the minutes and presentations, in chronological order, from the eight meetings relevant to the Facility Plan.

#### **2.1.2.5 List of Meetings and Topics Covered**

The following briefly describes the topics covered at each WWT Stakeholder Group meeting:

- **December 9, 2014**—This meeting provided an update on IOAP implementation. The WWT Stakeholder Group outreach index that will measure the effectiveness of MSD’s use of the group’s time and resources was introduced. The Facility Plan effort and the WWT Stakeholder Group’s role were discussed. The WWT Stakeholder Group facilitator was introduced, and the plan for future meetings was discussed.
- **March 24, 2015**—This meeting introduced the Facility Plan and specifically described the scope and planned work efforts related to Facility Plan stormwater and wastewater service areas.
- **June 23, 2015**—This meeting described the scope and planned work efforts related to the Facility Plan flood protection and property services areas. Values to be used in the values-based decision-making model for evaluating and prioritizing future projects were initially introduced and discussed.
- **August 11, 2015**—This meeting involved prioritizing values and aspects to be used in developing the cost/benefit project evaluation tool for the Facility Plan. Exercises were conducted to assign weighting of aspects and values. Because not all of the WWT Stakeholder Group members were present, and because those in attendance agreed that every effort should be made to include input from all stakeholders, MSD implemented an online input interface a few days after the meeting and invited those who were unable to attend to enter their evaluations using this method.
- **September 22, 2015**—This meeting presented results from stakeholder input and surveys on values and aspects. Using a scoring matrix for Facility Plan projects was reviewed by conducting a scoring for an example project and discussed.
- **December 1, 2015**—At this meeting, stakeholders were updated regarding the four Facility Plan service areas (Ohio River flood protection, wastewater, property, and stormwater and drainage) and identification of potential future projects.
- **March 22, 2016**—At this meeting, stakeholders provided feedback on presentations prepared by MSD and the Facility Plan Team to document needs within MSD’s system and to present recommended spending projections to bring the community’s wastewater, stormwater, and flood protection systems up to current design standards.
- **May 25, 2016**—This meeting allowed stakeholders to comment on an updated version of the presentations reviewed at the March 2016 meeting. Feedback on how best to communicate the

infrastructure needs of the community was also sought. The meeting also reviewed the approach for incorporating risk into the project prioritization process.

- **September 29, 2016**—This meeting focused on the draft versions of the Stakeholder Vision and Stakeholder Support memorandums to be used as the basis for the Stakeholder Group’s expression of support for the Facility Plan. Feedback on the documents was requested and received with the aim of finalizing the documents in a version the group was comfortable signing and/or supporting.
- **December 13, 2016**—The Stakeholder Vision and Stakeholder Support memoranda were revisited again to review the changes made per the group’s request. Additionally, financing options to fund the Facility Plan were discussed and the relative pros and cons evaluated.
- **April 18, 2017**—This meeting reviewed the impact that varying rate increases would have on MSD’s CIP. Specific programs and projects that would be delayed if an insufficient rate increase was approved were noted. The successes of MSD’s Community Conversations public outreach effort were presented to the WWT Stakeholder Group to document the depth and breadth of MSD’s outreach to the community.

#### **2.1.2.6 Establishment of Wet Weather Team Community Values**

A critical component from the WWT was their role in choosing the community values that would be used to prioritize projects. Including the WWT as the primary developers of the specifics used to calculate the benefits of a project allowed the Facility Plan to truly reflect the needs and principles of the community. This process of selecting the values and attributes that define them is more fully discussed in Volume 1, Chapter 3.

## **2.2 PUBLIC OUTREACH DURING PLAN DEVELOPMENT**

The Facility Plan was developed using community input obtained through the WWT Stakeholder Group since its inception. In the interest of the entire community, additional public outreach was also performed to solicit feedback from residents. This feedback was not meant to modify the recommendations of the Facility Plan, which is made based on sound engineering and scientific principles, but rather was to gather input on project schedule and funding needs. Sections 2.2 through 2.5 address these activities, and Section 2.6 describes the community conversation that occurred primarily between January 1, 2017 and May 1, 2017.

### **2.2.1 Public Meetings**

Public meetings specifically focused on the Facility Plan were not held while the plan was still in development. However, the plan was discussed during numerous community and organization meetings held after flooding in several neighborhoods during spring and summer 2015. At most meetings, the draft findings of the Facility Plan were shared and the implications, in terms of level of service and cost to prevent similar events, were explained. A list of these meetings is included in Table 1.2-7.

**Table 1.2-7. Public Meetings**

Date	Location
September 24, 2015	City of Prospect
November 10, 2015	City of Hurstborne
January 13, 2016	City of Douglas Hills
March 18, 2016	Kentucky Society of Professional Engineers
March 21, 2016	City of Richlawn
April 13, 2016	City of Hurstborne
May 4, 2016	Building Industry Association
May 24, 2016	City of Hurstbourne
June 6, 2016	Greater Louisville, Inc.
June 16, 2016	Jefferson County League of Cities

### **2.2.2 Advertising and Print Media**

In 2016, as part of its strategic plan, MSD began a multilayered advertising campaign to educate the community on its role and how it benefits the community. The Facility Plan has been developed within the framework of MSD’s strategic plan and supports MSD’s mission, as expressed in the educational campaign. With the completion of the final draft Facility Plan, the advertising portion of the media message shifted to include more information about the Facility Plan’s findings and recommendations. During June 2015, MSD presented information to Louisville Metro Council regarding the Facility Plan’s preliminary findings and future needs for a rate increase to address the many needs found in the Facility Plan. These efforts were widely covered by local print and radio news as leading stories. MSD referred to the Facility Plan often and it was cited as the justification for a potential rate increase in the future.

The Facility Plan preliminary findings were first presented to the MSD Board in an Infrastructure Committee meeting during September 2014. Since then, numerous stories have been presented in the local print and electronic media that were directly or indirectly related to Facility Plan findings. Examples of these stories published or broadcast between September 2014 and August 2016 are as follows:

- “Emergency Plans coming for “high hazard” dams;” WDRB 41; September 25, 2014
- “Trolley gets stuck in sinkhole downtown;” WAVE 3; November 7, 2014
- “Crews on deadline to get 4th Street hole fixed before “Light Up Louisville;” WDRB 41; November 13, 2014
- “MSD approves floodplain study;” *Louisville Courier-Journal*; November 25, 2014
- “Study finds regional sewers too costly;” *Louisville Courier-Journal*; January 13, 2015

- “Kentucky, Indiana have billions in water, sewer needs;” *Louisville Courier-Journal*, January 19, 2015
- “MSD working to clear nearly 68K storm drains, catch basins before rain;” WHAS 11 February 19, 2015
- “MSD prepares for potential flooding;” WLKY 32; March 3, 2015
- “Local roads and parks underwater as Ohio River continues to rise;” WDRB 41; March 9, 2015
- “MSD flood pumping stations press on as river crests in wake of snow, rains;” WDRB 41; March 10, 2015
- “Heavy rain prompts water rescues, evacuations;” *Louisville Courier-Journal*; April 3, 2015
- “Louisville’s one day record for April rainfall causes flooding all over the city;” WDRB 41; April 3, 2015
- “100 million gallons of sewage flows into Ohio River after power outage at treatment plant;” WFPL News; April 9, 2015
- “Lightning may have triggered massive sewage spill;” *Louisville Courier-Journal*; April 9, 2015
- “What you need to know about the possible home buyout for flooded Louisville homes;” WFPL News; April 30, 2015
- “Flood mitigation workgroup works to aid repeat flood victims;” WLKY 32; May 11, 2015
- “MSD walks back threat of FEMA downgrade after measure to help flooded-out homeowners fails;” Insider Louisville; May 19, 2015
- “Sewer plant fix to cost more than \$10 million;” *Louisville Courier-Journal*; May 26, 2015
- “Funding for short-term flood buyout program won’t come from Louisville Metro;” WFPL News; June 18, 2015
- “Louisville homeowners deal with devastating floods (yet again) following weekend storm;” WFPL News; July 13, 2015
- “Hurstborne seeks relief from chronic flooding;” *Louisville Courier-Journal*; July 14, 2015
- “Louisville’s flooding issues are widespread and growing, and a fix may be years away;” WFPL News; July 22, 2015
- “Metro Council members want more money for flood buyout program;” WDRB 41; September 9, 2015
- “Ohio River to rise to flood stage this week;” *Louisville Courier-Journal*; December 28, 2015
- “New Years sewage spill into Beargrass Creek;” *Louisville Courier-Journal*; December 31, 2015
- “Smoketown neighborhood seeks to change basin project;” WLKY 32; March 23, 2016
- “Smoketown fix shines light on MSD rates;” *Louisville Courier-Journal*; March 28, 2016
- “MSD considering more than 7% rate hike;” *Louisville Courier-Journal*; May 5, 2016 (also covered by WFPL News, WAVE 3, WHAS 11)

- “Climate change could be making sewer bills rise;” *Louisville Courier-Journal*; May 5, 2016
- “Metro Council resistant to 20% rate hike;” *Louisville Courier-Journal*; June 6, 2016
- “City plays Russian roulette with flood protection;” *Louisville Courier-Journal*; June 12, 2016
- “Giant sewage tunnel planned for under downtown;” *Louisville Courier-Journal*; June 28, 2016
- “MSD officials get input from neighbors in flood prone areas;” WDRB 41; July 7, 2016
- “Broadway blocked by aging sewer collapse;” *Louisville Courier-Journal*; August 3, 2016
- “MSD offers river area buyouts with \$2.6 million grant;” *Louisville Courier-Journal*; August 31, 2016

### **2.2.3 Electronic and Social Media**

MSD’s outreach efforts also considered extensive electronic and social media components, and these methods will be fully used in the future to convey the findings of the Facility Plan. Electronic and social media were identified by the outreach team as key channels for reaching MSD’s customers, considering the widespread use and increasing preference over other media forms.

### **2.2.4 Other Events**

MSD regularly provides volunteer staff and provides outreach materials for community events, such as concerts, festivals, and river-sweeps. Staff often set up a well-marked booth and are available to provide information and answers to customers. This type of one-on-one interaction with customers is critical and will be used to communicate Facility Plan results.

## **2.3 REGULATORS**

MSD has regular conference calls and meetings with state and federal regulators as part of the ACD response, IOAP implementation, and MS4 coordination. Key regulators are well aware of the Facility Plan and its findings and, in particular, the needs of the community beyond overflow control. As the Facility Plan is implemented, this will be a key group to keep engaged to make certain they understand the long-term vision and direction MSD is taking.

## **2.4 ELECTED OFFICIALS**

The WWT includes two members of the city council, several members of city government, representatives from small cities within MSD’s service area, and mayoral staff. As noted in Section 2.1.2, part of their role is to convey the information they learn at the WWT meetings to their coworkers, constituents, and organizations. Additionally, MSD regularly meets with elected officials to keep them apprised of current and future projects, and to allow them to express their concerns and needs. On June 2, 2016, MSD made a presentation to the Metro Council Budget Committee, describing the preliminary findings of the Facility Plan and presenting funding needs to implement the Facility Plan within the 20-year planning horizon.

## 2.5 LOUISVILLE AND JEFFERSON COUNTY METROPOLITAN SEWER DISTRICT BOARD

As noted in Section 2.1.1.1, the MSD Chief Engineer’s Report regularly presented information on both Facility Plan progress and findings at the monthly Board meetings and at Board committee meetings. In addition, the Facility Plan Team made several presentations to the Board and its committees to discuss First Plan scope and progress first hand, and staff presented on the capital and operating budgets that incorporated Facility Plan recommendations. Board and committee meetings are open to the public, and are often attended by members of the press who report on Board activities. A list of the meetings with presentations relevant to the Facility Plan is included in Table 1.2-8.

**Table 1.2-8. Board and Board Committee Meetings**

Date	Presentation Purpose
September 8, 2014	Infrastructure Committee—Facility Plan scope and schedule
September 8, 2014	Finance Committee—Facility Plan scope and schedule
September 22, 2014	MSD Board—Facility Plan scope and schedule
February 2, 2016	Infrastructure Committee—preliminary 5-year CIP recommendation
May 2, 2016	Finance Committee—proposed (fiscal year) FY2017 operating budget
May 2, 2016	Infrastructure Committee—proposed 5-year CIP
May 23, 2016	Finance Committee—proposed FY2017 budget
August 18, 2016	Infrastructure Committee—draft 20-year CIP recommendation
November 28, 2016	Infrastructure and Finance Committees (joint meeting)—Facility Plan financing options
February 14, 2017	Infrastructure Committee—progress report on the Community Conversation initiative
April 18, 2017	Infrastructure and Finance Committees (joint meeting)—preliminary FY2018 capital and operating budgets
May 5, 2017	Infrastructure and Finance Committees (joint meeting)—proposed FY2018 rate increase

## 2.6 COMMUNITY CONVERSATION

### 2.6.1 Overview

Matters of public health and safety impact all community members, and discussions around these matters require an open and far-reaching process that brings many voices into the dialogue. MSD staff, supported by the Facility Plan Team, coordinated a wide-reaching Community Conversation initiative aimed at fostering constructive dialogue about the realities of the public health and safety risks, as well as the costs of the required solutions as outlined in the 20-Year Comprehensive Facility Plan. The Community Conversation Team felt that the term “Facility Plan” was not well understood by external

stakeholders, so the phrase “Critical Repair and Reinvestment Plan” was developed to better represent the intent. This is the term used for the Facility Plan in the communication materials developed for the Community Conversation. As the challenge of an estimated \$4.3 billion required reinvestment in its wastewater, stormwater, and flood protection systems is confronted, the Louisville community provided input about the timing of addressing the risks presented by these aging systems. The impacts of delay on the local economy and job creation, as well as increased future costs to implement solutions, were also part of the discussion.

MSD’s community engagement approach focused on going out into the community for two-way dialogue at existing community gatherings. In addition to copies of the draft Facility Plan available for public review online, copies are available at the MSD main office building and are accessible through all the public libraries in Louisville Metro. This framework was supported by information developed to be relevant and public-friendly. Local examples and photographs connected the impacts of aging wastewater, stormwater, and flood protection systems to real-world community concerns. A robust social media effort helped disseminate information, and a dedicated website with videos provided both overview and in-depth resources to inform the community. Many community groups contributed to broadening the effort’s reach by sharing information in their own newsletters and emails. Community comments and feedback were gathered through a Community Input Form posted online and made available in paper form at community meetings. Comments and questions posed at these community meetings were also documented.

A complete report on this outreach effort is contained in the *Community Conversation Status Update, June 1, 2017*, included as Appendix 1F. The following briefly summarizes this report and presents some of the key results.

- Stakeholder outreach occurred primarily between January 1 and May 1, 2017. Citizens were receptive to becoming informed about the challenges, and they offered feedback representing a range of perspectives and insights. Following are highlights of the engagement process:
  - 122,858 MSD residential customers who receive paper bills were mailed a bill insert providing an overview of the Facility Plan, encouraging them to attend community meetings or review the information on the MSD-dedicated Facility Plan website and complete a customer input form at a meeting or online.
  - 1,476 community members engaged in the conversations, attending one of nearly 30 meetings held to which more than 60 established community groups were invited.
  - 413,449 impressions were garnered from social media posts through Facebook and Twitter.
  - 9,165 views of the dedicated Facility Plan website occurred, with an average time of 1:22 spent on key pages.
- Feedback was received from 417 citizens who chose to engage through one of the outreach initiatives mentioned above. Highlights of the community input received from those who chose to engage are as follows:

- 90 percent understand and agree with the need for investing in the community’s wastewater, stormwater, and flood protection systems to reduce risks to public health and safety, rather than continuing to defer critical repairs and reinvestment.
- 71 percent support an increase in residential rates of up to \$10 per month (with a proportional increase in industrial and commercial rates) to immediately begin funding critical wastewater, stormwater, and flood protection projects to address the identified public health and safety risks.
- 89 percent believe now is the time to begin addressing the public health and safety risks.
- 78 percent support expanding MSD’s Rate Relief Program to assist customers who meet federal criteria established for other utility rate assistance programs.

This input echoes the priorities identified by local citizens at the 100 Resilient Cities Workshop hosted by Louisville Metro in early 2017, including the risks of severe or catastrophic weather, infrastructure vulnerability, and aging infrastructure. With a Chief Resiliency Officer now on board, Louisville is ready to begin addressing the shocks and stresses that challenge our community’s resiliency. The Facility Plan directly responds to the resiliency issues related to aging infrastructure, climate change, and public health protection.

## **2.6.2 Community Conversation Approach**

The Louisville community deserves to be informed on these matters of public health and safety, and likewise, should have a voice in the conversation about the timing of necessary infrastructure investments. MSD committed to facilitating discussions with customers, business leaders, elected officials, and others. With this overall goal, MSD undertook the wide-reaching “Community Conversation” initiative described in this section aimed at bringing many perspectives to the table for constructive dialogue. This dialogue did not center around “*whether*” the risks to the public health and safety of families and business owners will be addressed, but rather “*how soon should the work begin.*”

### **2.6.2.1 Community Conversation Objectives**

MSD developed a comprehensive and strategic outreach effort aimed at speaking directly with citizens about the infrastructure improvements needed for reducing the community’s risks and gathering customer input on balancing risk reduction with additional investment. Community input was necessary to determine how soon the critical projects should be completed. The answer to this question drives the decisions about necessary near- and long-term infrastructure investments.

The Community Conversation included the following objectives:

- Actively generate community conversation about issues, needs, and investment requirements for the community’s vital wastewater, stormwater, and flood protection infrastructure.
- Identify opportunities with community partners to bring many voices to the table.
- Provide meaningful, tangible, and understandable information across a broad range of communication channels to ensure access for all sectors of the community.

- Build credibility by delivering exceptional customer service and demonstrating responsible stewardship of ratepayer resources.
- Gather input about the community’s desired level of service based on realistic understandings of cost and affordability.

### **2.6.2.2 Developing Relatable Message**

Every member of the Louisville community benefits from the wastewater, stormwater, and flood protection systems that protect public health and safety. However, MSD recognizes that connecting a system of pipes and structures that is largely “out of sight and out of mind” to the general public requires creating a focus on meaningful and understandable information relevant to daily life.



*Tony Parrott Leading a Community Conversation Meeting*

Given that the MSD service area covers a diverse range of neighborhoods and issues, the various risks to public health and safety associated with the system were separated into six categories with a specific “neighborhood-level” example selected to illustrate each category. The investment cost needed for each category was presented, along with images and pictures depicting the impacts. Table 1.2-9 summarizes the categories, risks, estimated solution costs, specific examples, and justification.

Messaging also included the impact of increased frequency of extreme storm events on Louisville’s aging systems. Presentations and discussions included information on the analysis of the National Weather System station at the McAlpine Lock and Dam, which shows the frequency of 3-inch rains at that location is increasing from one every 2.6 years to one every year. MSD’s operating experience shows that a 3-inch rain in 24 hours will cause localized flooding in parts of the system in Louisville. These storm events not only cause flooding, but also put extra strain on the aging system that is already struggling to keep up.

### **2.6.2.3 Communication Materials**

Recognizing that community meeting attendance may not be an option for everyone, a webpage was created to convey information that would be available at meetings. Information from the Facility Plan can be found on a dedicated page, including a video message about the challenge and the opportunity to engage in conversation, brief summaries of the risks to public health and safety, including local pictures of real consequences, and links to the full Critical Repair and Reinvestment Plan for review.

**Table 1.2-9. Critical Repair and Reinvestment Plan Summary of Community Risks**

Category	Risk	Estimated Solution Costs (millions)	Specific Example	Justification
Upgrade ORFPS	System prevents the catastrophic impacts of Ohio River flooding.	\$683	Paddy's Run FPS	The system comprises 1950s technology with a 21st-century job of protecting 70,000 homes, 6,000 businesses, and more than 40 neighborhoods.
Reduce Neighborhood Flooding	Inland flooding occurs whenever a heavy rainstorm overwhelms the stormwater and drainage system.	\$1,200	Okolona-area basement flooding; water rescues in the Sutherland and Dunbarton areas (map with highlighted areas across entire community)	Even if one does not live in an area with inland flooding, they may work there, their children may go to school there, or the nearest hospital may be located there. Also, runoff from one's property could contribute to flooding in lower areas.
Minimize Viaduct Flooding	Viaduct flooding impacts public safety, business growth, and emergency services response (for example, police, fire).	\$435	Viaduct at 3rd Street and Eastern Parkway (in the heart of University of Louisville campus)	This major transportation corridor, when flooded, causes ripple effects for commuters, students, and public safety vehicles like fire, police, and ambulances; also, this corridor provides major access to a 40-acre technology park. The corridor also affects student quality of life and safety, as well as investment in the expansion of Papa John Stadium.

**Table 1.2-9. Critical Repair and Reinvestment Plan Summary of Community Risks**

Category	Risk	Estimated Solution Costs (millions)	Specific Example	Justification
Prevent Collapsing Sewers	System across the community is aging; the oldest sections are in the most densely populated and critical economic sectors, but also have 75-year-old systems across the community.	\$496	Sewer collapse on Broadway and Floyd Street in 2015	Brick sewer under Broadway was built in 1867; fortunately, no vehicle was on top when the roadway collapsed. A car, ambulance, fire truck, or school bus could have been on top. This was the fourth collapse of the line since 2012.
Upgrade Wastewater Treatment Facilities	MSD maintains five major treatment facilities; interrupting operation at any facility would seriously impact the potential for environmental damage and the potential for public contact with bacteria and other pathogens in the waterways of Jefferson County.	\$849	Morris Forman WQTC power outage in 2015	Morris Forman WQTC began operation in 1958, is the largest in Kentucky, and serves a large area of the community. The facility suffered a total power outage in 2015, resulting in flooding and seriously impacting operations. Millions of gallons of untreated wastewater were discharged to the Ohio River until treatment operations were restored.
Comply with ACD	ACD requirements are not related to wastewater treatment or infrastructure renewal, plus support systems.	\$617	Sewer overflow storage basins, specialty equipment, more than 200 aboveground facilities, and computer and communication technology systems	ACD requirements are not all related to treatment or infrastructure renewal. Sustaining MSD's daily operations requires normal business systems in addition to the specialty equipment unique to wastewater and drainage utilities.

Based on each public health and safety risk category, a variety of communication materials were developed to personalize issues (that is, to make more relatable), visually convey messages about MSD service delivery at the local level, and clearly explain the issues and needs. Map boards and highlight sheets were created to present the community-relevant information with supporting visuals. The highlight sheets were also used as the basis for content for the dedicated CRRP website (Figure 1.2-1 depicts a sample highlight sheet). Appendix 1F contains samples of these communication materials, including MSD newsletters, posters, bill inserts, highlight sheets, Microsoft PowerPoint presentations, videos, infographics, maps, and more.

### **2.6.3 Community Engagement**

To ensure that representative voices across all areas of the community were engaged in the dialogue, MSD undertook significant efforts to make information accessible to members of the community across the entire Louisville area.

#### **2.6.3.1 Preliminary Input from Business and Professional Groups**

To ensure the success of the community dialogue, MSD recognized the importance of gaining an understanding of the types of questions the community would have about the challenges of aging systems. Preliminary input from various community leaders and groups was gathered to ensure information to the broader community would be effective and meaningful. Among the groups engaged were the Building Industry Association of Greater Louisville, Downtown Rotary Club, Louisville Chapter of the Kentucky Society of Professional Engineers, and Greater Louisville, Inc.



*Building Industry Association Community Conversation Meeting*

#### **2.6.3.2 Employee Engagement**

With more than 600 employees, MSD itself represents a broad range of neighborhoods and demographics. MSD employees also communicate directly with customers daily while on the job. To leverage these insights and perspectives while engaging staff as knowledgeable “information ambassadors,” MSD conducted internal sessions with employees to gather feedback and allow questions to be answered directly, ensuring employees have accurate information to provide to the public about the Facility Plan. This included outreach to the following Union organizations and their members:

- Laborers International Union of North America—151 members
- National Association of Government Employees—128 members



## PUBLIC HEALTH & SAFETY RISK:

# Collapsing Sewer Infrastructure





As Louisville's sewer system continues to age, the likelihood of failure increases. The oldest sections of the system that collect wastewater from homes and businesses are located in the most densely populated and critical economic sectors of Louisville, while 75-year-old sections are located across the entire community. These systems were designed and built when Louisville was a much smaller community and are not equipped to handle today's population or support future growth.

It is not simply the century-old structures that are at risk. The massive gates in the Southwestern Sluice Gate Structure, originally installed in 1975, are the last line of defense from the Ohio River for much of west and southwestern Jefferson County. In 1983 these gates failed during an intense rain event, flooding 2,000 homes and businesses. First responders struggled to gain access to evacuate victims because streets were under several feet of water and sewage. One of these same sluice gates failed again in 2016 during routine operations. MSD crews worked around the clock to secure the gate so public safety would not be compromised if a flood event occurred. As a result, MSD is proceeding with replacement of all three gates using emergency funds.

### Did you know?

A large portion of the sewer under Broadway in the heart of downtown Louisville is made of brick—not steel or concrete—and was built in 1867, shortly after the Civil War ended. Because it is made of bricks, the structure literally begins to “unravel” when just one or two bricks start to fail.





#### Real-World Consequences

In 2015, the old Civil War-era sewer under Broadway and Floyd Streets collapsed. As the bricks unraveled, businesses and commuters in Louisville's main business and hospital district had to maneuver around the large gaping hole in this busy roadway. Thankfully, there was not a vehicle, such as a school bus, on top when the roadway opened up. The sewer system in that area has experienced four major collapses since 2012.

For more information, visit  
[LouisvilleMSD.org/CriticalRepairPlan](http://LouisvilleMSD.org/CriticalRepairPlan)  
 502.587.0603  
[CustomerRelations@LouisvilleMSD.org](mailto:CustomerRelations@LouisvilleMSD.org)  
  [LouisvilleMSD](https://www.facebook.com/LouisvilleMSD)

(600) 0177

**Figure 1.2-1. Sample Highlight Sheet**

### **2.6.3.3 Community Meetings**

One aspect of the outreach effort was face-to-face dialogue at community meetings. MSD requested opportunities to meet with existing community groups, rather than solely relying on MSD-sponsored public meetings and transmitted information (including website links and meeting opportunities) via their newsletters and communication forums, to meet people within their own neighborhoods and interest areas. These groups and organizations bring value to the outreach effort by sharing insights from a business, common good, economic, neighborhood-level, or other important perspective. The groups represented a cross-section of civic and business interests, neighborhood associations, and faith-based organizations. Also, groups and neighborhoods across Louisville were encouraged in communications distributed to the community to contact MSD to arrange presentations.

Also, MSD mailed a bill insert (see Figure 1.2-2) to the nearly 123,000 MSD residential customers that receive a paper bill, encouraging individuals to either attend a community conversation meeting or review the information on the MSD website to learn about the Facility Plan initiative.

Appendix 1F lists meetings where MSD made presentations to a group of community members, including the group name, presentation date, and number in attendance. To expand the reach beyond the actual meeting, MSD sent a follow-up thank-you and request to the community group leadership requesting that an informational email be distributed to all members providing information about the Facility Plan, directing them to the MSD website for more information and encouraging them to complete the Community Input Form.

In addition to the presentations at community meetings, MSD blanketed the community with information through other means, as follows:

- Copies of the Facility Plan were made available at all Louisville Free Public Library branches for review and input.
- The Facility Plan was made available on the MSD website.
- The presentation given to the Metro Council Inter-Governmental Affairs Committee was streamed live and subsequently replayed multiple times on MetroTV.
- News articles provided coverage across the entire community.
- Facility Plan radio coverage was provided on WLOU.
- Interviews and discussion of the Facility Plan occurred on WLKY, with a Point of View segment scheduled for WDRB.
- Advertisements were published.
- Content was provided for community group newsletters and other third-party communication channels to further broaden the reach to members of the community; Appendix 1F contains examples of these placements.

## Message to the community—aging critical infrastructure

February/March 2017

Louisville, like many cities, is faced with aging infrastructure that must be maintained and refurbished in order to continue to serve a growing community. Some of MSD's underground infrastructure predates the Civil War, and much of our flood



Tony Parrott  
MSD Executive  
Director

protection system was built in the 1940s and '50s. In addition, an increased frequency of severe storms in recent years has amplified the need for our system to be ready to protect against the worst of today's weather.

MSD has completed an extensive analysis of these systems and has developed a Critical Repair & Reinvestment Plan to address the challenges posed by this aging infrastructure. The difficult truth is the solutions come with a price tag of \$4.3 billion over the next 20 years, including almost \$500 million to finish the remaining Consent Decree projects to meet the federal order to reduce sewer overflows.

### We want to hear from you:

Louisville can no longer avoid renewing and restoring its vital wastewater, flood protection and stormwater management facilities. Input is needed from the community to determine how soon the critical projects should be completed.

The entire Critical Repair & Reinvestment Plan is online for your review, as well as available in each of Louisville's public library branches. To view the Plan and provide feedback, visit [LouisvilleMSD.org/CriticalRepairPlan](http://LouisvilleMSD.org/CriticalRepairPlan)

The bottom line is this: at MSD, we're here to make Louisville a better place. A cleaner place. A healthier place. To have a real impact on the quality of life of the place we all call home. Working together, we can continue to pursue our Vision of "Safe, Clean Waterways for a Healthy and Vibrant Community."

Sincerely,



James A. Parrott  
MSD Executive Director

## Plan your rain garden now



Rain gardens help infiltrate rainwater before it reaches the drainage system, and reduce the amount of stormwater and pollutants running into storm drains, combined sewers or streams.

For your **FREE Rain Garden Guide**, contact MSD Customer Relations at 502.587.0603, or online at [CustomerRelations@LouisvilleMSD.org](mailto:CustomerRelations@LouisvilleMSD.org).



**CONTACT US 24/7/365  
502.587.0603**

[CustomerRelations@LouisvilleMSD.org](mailto:CustomerRelations@LouisvilleMSD.org)



**Figure 1.2-2. February/March Bill Insert**

A robust online and social media campaign was also employed to broaden the reach, making information accessible literally at citizens' fingertips via a smartphone or tablet. Along with regular Twitter and Facebook posts, MSD broadcast Facebook Live and Periscope feeds that allowed community members to hear presentations and participate in conversations remotely.



Figures 1.2-3 and 1.2-4 show the social media and webpage analytics, respectively, for MSD's Facebook, Twitter, and Facility Plan website during February through May 2017 (the most intense period for the Community Conversation meetings and promotion). An impression is the chance that someone had to see the post through their feed. The impressions on social media during these 3 months amounted to 413,449. The social media campaign drove customers to the Facility Plan website information and survey, which happened 6,021 times during this 4-month period.

The MSD Facility Plan webpage had 9,165 visitors between February and May 2017, with an average time on the page of 1:12 spent on the page. These hits made this page on the MSD website second in terms of viewers behind the MSD Main Page.

#### 2.6.4 Community Input

Given that a primary goal of the Community Conversation was to gather input from community members about the Facility Plan, MSD undertook an extensive effort to capture community comments and feedback across multiple platforms. To record structured input, a Community Input Form was developed. Community members were asked to select from a series of statements that best represented their viewpoint. The Community Input Form was available online through the MSD website, and hard copies of the form were also provided to community members at every meeting where MSD presented. Figure 1.2-5 presents information requested on the form.


Ultimately, MSD presented and engaged in dialogue with citizens in locations across the entire Louisville community. Through May 1, 2017, MSD has reached 60 community groups through presentations and dialogue at nearly 35 different community meetings attended by almost 1,500 people. The input from all of those who chose to engage is summarized in the following questions.

FEBRUARY - APRIL, 2017			
CRITICAL REPAIR & REINVESTMENT PLAN			
SOCIAL MEDIA ANALYTICS			
PLATFORM	NUMBER OF POSTS/TWEETS	Number of times post is displayed (IMPRESSIONS)	WEB VISITS FROM SOCIAL MEDIA POSTS
FACEBOOK 	85	129,205	2,628
TWITTER 	143	168,118	1,710
TOTAL	228	297,323	4338

**Figure 1.2-3 Facility Plan Social Media Analytics**

FEBRUARY - MAY 2017		
CRITICAL REPAIR & REINVESTMENT PLAN WEB PAGE		
MSD WEBSITE ANALYTICS		
PAGE VIEWS (each time a visitor views a page)	AVERAGE TIME ON PAGE	CRRP WEB PAGE RANK
9165	1 min, 12 sec	2

**Figure 1.2-4 MSD Website Analytics**



**CRITICAL REPAIR & REINVESTMENT PLAN**  
**Voice your opinion**

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our newsletter?    No    Yes, postal mail    Yes, email


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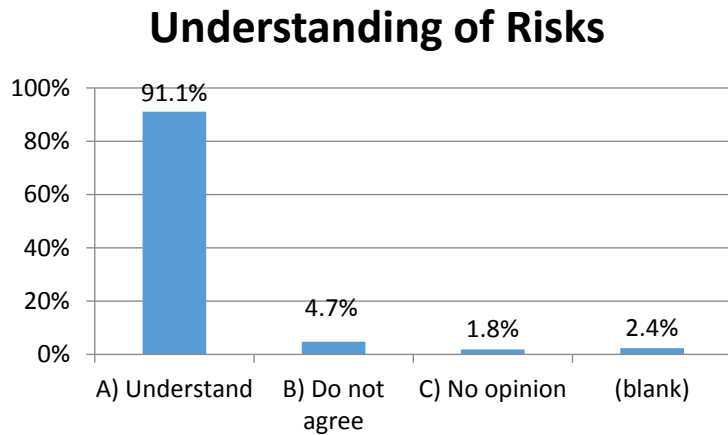
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For more information visit [LouisvilleMSD.org/CriticalRepairPlan](http://LouisvilleMSD.org/CriticalRepairPlan)  LouisvilleMSD

**Figure 1.2-5. Community Input Form**

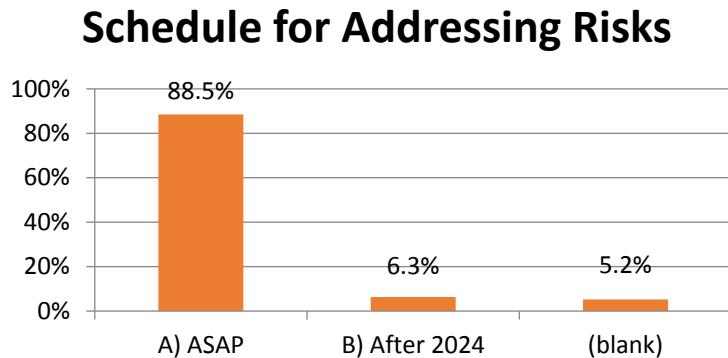
**QUESTION 1**

- A. I understand and agree with the need for investing in the community’s wastewater, stormwater and flood protection systems in order to reduce risks to public health and safety rather than continuing to defer critical repairs and reinvestment.
- B. I do not agree that the risks to public health and safety are as great as presented.
- C. I do not yet have an opinion on this.



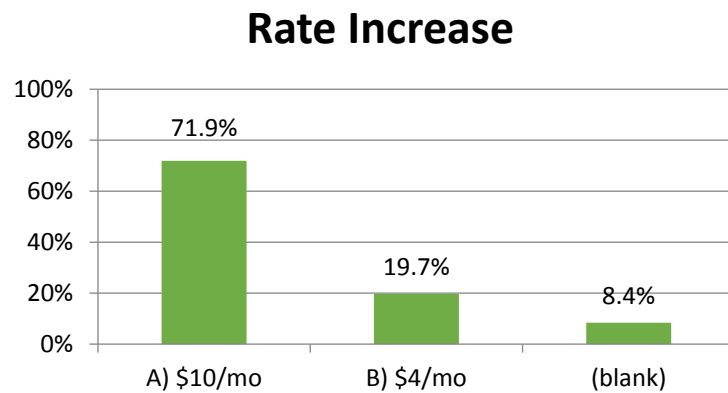
**QUESTION 2**

- A. I believe it is important to begin addressing the public health and safety risks as quickly as possible.
- B. I believe that MSD should defer addressing these public health and safety risks until after 2024 when the required federal ACD work is complete.



**QUESTION 3**

- A. I support an increase in residential rates of up to \$10 per month (with a proportional increase in industrial/commercial rates) to immediately begin to fund critical wastewater, stormwater, and flood protection needs to address public health and safety risks.
- B. I prefer an increase in residential rates of not more than \$4 per month (with a proportional increase in industrial/commercial rates) with the understanding that this



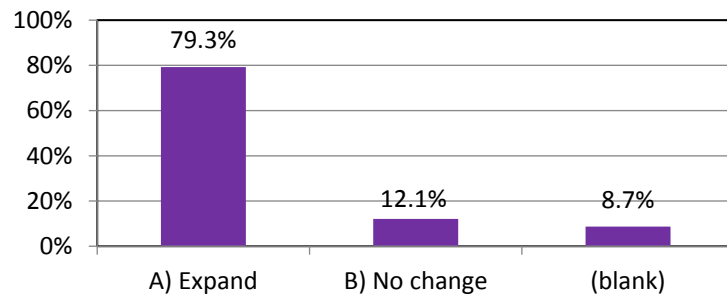
continues to defer critical repairs and reinvestment in wastewater, stormwater, and flood protection needs.

**QUESTION 4**

A. I support the expansion MSD’s Rate Relief Program to assist customers who meet federal criteria established for other utility rate assistance programs.

The Facility Plan Team believes this input validates need to immediately being to implement do not support the recommended expansion of MSD’s Rate Relief Program to assist customers who meet federal criteria for other utility rate assistance programs and projects as presented in draft copy of the Facility Plan.

**Expansion of Rate Relief**



**2.6.5 Community Conversation Summary**

Community input confirms that Louisville supports restoring its vital wastewater, flood protection, and stormwater management facilities. Responses from those who engaged in the community conversation are as follows:

- 91 percent of the respondents understand and agree with the need for investing in the community’s wastewater, stormwater, and flood protection systems to reduce risks to public health and safety, rather than continuing to defer critical repairs and reinvestment.
- 89 percent of the respondents believe beginning to address the public health and safety risks as quickly as possible is important.
- 72 percent of respondents support an increase in residential rates of up to \$10 per month (with a proportional increase in industrial and commercial rates) to immediately begin to fund critical wastewater, stormwater, and flood protection needs to address public health and safety risks.
- 79 percent of the respondents support expanding MSD’s Rate Relief Program to assist customers who meet federal criteria established for other utility rate assistance programs.

Overall, this input echoes the priorities identified by local citizens at the 100 Resilient Cities Workshop hosted by Louisville Metro in early 2017, including the risks of severe or catastrophic weather, infrastructure vulnerability, and aging infrastructure.

## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 3 PROJECT EVALUATION AND PRIORITIZATION

#### 3.1 COST ESTIMATING

Cost estimating used for evaluation of alternatives and projects entailed the development of capital costs, operating costs, and life-cycle costs. Costs developed during facility planning are intended as planning-level costs used to compare multiple solutions to determine those that should be the focus of a more detailed analysis, to compare proposed projects within a service area and among all service areas, and to provide budgetary estimates for long-term capital planning. Estimates were prepared based on best available data at the time they were developed. More detailed estimates of project costs should be prepared as projects move to detailed design stages.

The project cost-estimating tool developed and used for the IOAP was used where applicable (for example, conveyance [sewer pipes, force mains, and wastewater pump stations] and storage projects). Standard template formats for other project types and facilities were developed to ensure a comparable level of detail for estimates and use of common unit costs as applicable. WQTC facilities under the wastewater service area and projects in the property service area are examples of such other project types. WQTCs were estimated based on structures and/or unit process, using unit costs and equipment prices from similar MSD projects where available, or projects from other locations, adjusted for geographical differences using the 20-City *Engineering News Record* Construction Cost Index (ENR-CCI). Construction cost estimating for the property service area was primarily based on use of the Means Estimating Guide. Estimates for flood protection projects were found to be unique and not conducive to an estimating tool approach. For flood protection projects, cost curves were developed based on other large pump station projects to develop estimates based on capacity.

Many of the stormwater projects are incorporated as part of programs such as the Drainage Response Initiative (Project DRI). These projects tend to be smaller and were not re-estimated individually. Rather, the program was examined holistically and cost opinions were developed at the programmatic level. For other stormwater projects, quantities of construction materials were estimated and unit prices from recently bid projects were used to develop costs.

##### 3.1.1 Capital Costs

Capital cost is the total cost to design, construct, and administer a project. These costs include the construction cost and costs for program management, administration, easement, property acquisition, and contingencies; miscellaneous costs such as borings; designer engineering services during construction; construction inspection services; interest (during construction); planning and preliminary design; design services; modeling; and performance bond. To normalize opinion of costs from previously planned projects and new projects identified during the development of the Facility Plan, the ENR-CCI was used. The ENR-CCI for Cincinnati, Ohio, was used as the reference location as it was the nearest

metropolitan area to Louisville. The ENR-CCI for May 2016 was used as the reference to bring previously developed costs to today's levels.

Continuity across service areas was maintained by having cost opinions developed with standard information and professional best practices. To account for the non-construction costs in capital projects, standard markups were applied for contingency, interest, planning and design services, construction administration, program management, and general conditions. These factors added up to a 56 percent increase over the base construction cost opinion. Methods to calculate cost opinions were evaluated by the Facility Plan Team and MSD to confirm their validity and appropriateness for this level of planning.

### **3.1.2 Operating Costs**

Operations and maintenance (O&M) costs are the annual costs to operate and maintain a facility including labor, utilities, chemicals, repair parts, and other supplies. Impacts to operating costs for previously planned projects have already been determined through the IOAP or other studies. These incremental costs are added to the projected O&M budgets as a separate line item. For new projects developed under this Facility Plan, the incremental increase and decrease in operating costs were estimated using tools developed for the IOAP, industry standards, and literature reviews. For projects that could not be addressed through IOAP tools or other published references, the following factors were used in developing operating costs:

- Labor rate—\$35.24 per hour (average of union employees in FY 2016, including 35 percent for benefits)
- Energy costs—\$0.03926 per kilowatt-hour (kWh)
- Natural gas—\$7.07 per 1,000 cubic feet
- Treatment chemicals—\$118.67 per million gallons (MG) of treatment
- Disinfection chemicals—\$0.70 per gallon

For property service area, MSD's historical contracted mowing costs were used to update future costs.

### **3.1.3 Life-Cycle Costs**

Life-cycle costs are based on present worth value of project costs over a 20-year period, including the initial capital costs, annual O&M costs, and other periodic costs over the planning period such as equipment replacement and salvage value. Service life is the expected useful life of a portion of a facility before it needs to be replaced, and is considered in the calculation of life-cycle costs. Service life varies depending on the type of facility as follows:

- Sewers—70 years
- Treatment structures—50 years
- Process equipment—20 years
- Auxiliary equipment—10 years

Note that many of MSD's downtown and inner city sewers are more than 100 years old, and almost all flood pump stations are more than 60 years old. Most treatment and pumping facilities have equipment that has exceeded their intended service lives. This equipment is still in service due to the cost of replacement. Preventive and corrective maintenance costs are higher than for new equipment, due the need to keep this aging equipment operating reliably. The interest rate for life-cycle analysis was set up at 6 percent. While this is higher than MSD's current interest rate on long-term bonds, it is considered appropriately conservative for a long-term, life-cycle-based planning considering the historical swings in the bond market.

### **3.2 COMMUNITY VALUES**

Community values are issues of interest and concern that citizens want to protect and serve as program anchoring points and decision process inputs. Community values are categories of criteria used to assess threats and evaluate alternatives. Another way to define a community value is to consider it an outcome or goal.

To prioritize projects, the Facility Plan used a values-based decision model that uses a structured approach to quantify subjective items and standardize prioritization across competing interests. This is the same approach as was successfully used to select and prioritize projects in IOAP development of the IOAP. Values were identified to evaluate individual projects and program-level suites of solutions. The values have aspects associated with them that can be measured and thus quantified. The values are weighted to reflect the priorities and ideals of the stakeholders.

The community values evaluation process allowed the WWT to quantify a wide range of dissimilar problems, calculate the risk that the problem may have associated threats, and evaluate the benefits of each project using a consistent scale of measurement. Values-based risk management is a decision and prioritization process that systematically considers multiple objectives. This process is the mechanism by which the WWT Stakeholder Group, acting as representatives of the public, advised MSD on prioritization of projects in the Facility Plan.

#### **3.2.1 Value Identification Process**

The process of identifying community values for the Facility Plan was initiated with review and consideration of the values used for developing the IOAP, and determination of their applicability to the Facility Plan evaluations, keeping in mind the different scope of the Facility Plan. Consideration was also given to MSD's responsibilities, and the vision, mission, and values defined in MSD's *Strategic Business Plan 2014-2018* (MSD, 2014).

The WWT Stakeholder Group provided input and direction to the value identification process over a series of three WWT Stakeholder Group meetings held on June 23, August 11, and September 22, 2015. Initially, the values used in the IOAP process were presented and an open discussion was held regarding whether to use these values for the Facility Plan as is, or whether to modify, edit, delete and/or add new ones. The WWT Stakeholder Group, in conjunction with the Facility Plan Technical Team, developed a list of six project-specific values against which potential projects could be evaluated. The WWT

Stakeholder Group also helped identify the unique aspects that would be the defining measurement of each of the values.

The WWT Stakeholder Group was asked to weigh the importance of the aspects used to measure each of the six values, which were themselves the weighted evaluation criteria applied to all projects in the wastewater, stormwater, and flood protection service areas (because of the relatively low cost of the projects identified in the property service area and the criticality to operations and staff health and safety, property projects were exempted from the prioritization process and integrated into the recommended CIP according to their need). The WWT Stakeholder Group meeting on August 11, 2015 was convened for purposes of gathering quantitative importance evaluations for both aspects and values used to “weight” their relative importance against one another. The required quantitative evaluations were gathered from the stakeholders present at the meeting through the use of audience response systems, commonly referred to as “clickers.”

Since not all WWT Stakeholder Group members attended the August 11 meeting, and because those in attendance agreed that every effort should be made to include input from all WWT members, MSD posted a web version interface a few days later and invited those who were unable to attend to enter their evaluations through this method. The online interface was made available for 10 days and the subject members were given several reminders of the opportunity. Ultimately, three of five remaining members completed the survey. The online data were combined with the data gathered on August 11 to compute the overall ratings derived from the WWT Stakeholder Group.

The WWT Stakeholder Group, in conjunction with the Facility Plan Technical Team, refined and edited values to establish the community values for the Facility Plan. Part of the refinement process included identifying and defining aspects for each community value. Essentially, a community value’s aspects serve as both a practical definition and as a measurable criterion for the risk management process. For example, reducing pathogen exposure is a measurable aspect (criterion) related to the community value (goal) of public health protection. The process of identifying, defining, and refining continued until a consensus was reached regarding the content, wording, and meaning of each value, and the aspects associated with each value.

### **3.2.2 Project-Specific Values**

A final list of six project-specific community values was established, as listed in Table 1.3-1. A project-specific community value affects a specific project, or problem site. The risk management evaluation process used project-specific values to prioritize individual projects. A quantifiable scale was developed to score each of the aspects depending on the extent of the positive or negative impact a project would have on that aspect. To maintain consistency across aspects and value scoring, each aspect has the same possible scores of -5, -2, 0, 2, or 5. For example, the Terrestrial Habitat Aspect of the Environmental Impact Value scale was based on the acres of habitat disrupted or eliminated, enhanced or created. Decreases in acreage of 5 or more acres resulted in a score of -5, a slight decrease received a -2, no impact received a score of 0, a slight increase scored a 2, and an increase of 5 or more acres received a score of 5.

The scores of each aspect could be aggregated to develop the benefit score for each value, which could then be combined to create the total project benefits score—a quantified measurement of the project’s intangible benefits.

**Table 1.3-1. Project-Specific Values and Aspects**

Project-Specific Values	Aspects
Environmental Impacts	Terrestrial habitat, aquatic habitat, tree canopy, visual aesthetics, odor aesthetics, stream base flow, stream peak flow, nutrient loadings, impaired use impacts
Regulatory Compliance	Kentucky Pollutant Discharge Elimination System (KPDES), MS4, ACD, flood plain management, air pollution control permits, biosolids
Public Health Protection	Pathogen exposure, drowning risk, mold exposure
Property Protection	Basement backup, surface flooding – traffic disruption, surface flooding – structural damage, flood insurance rating, public utility delivery
Sustainability	Non-renewable resource consumption, mechanical vs. natural systems, multipurpose community asset, public access, public information/education enabler, reclaim abandoned or under-utilized land, impact on impervious surface, land use compatibility or improvement
Economic Vitality	Number of residential customers, flow/load from commercial/industrial

All six project-specific values were applied to some extent in evaluating projects in each of the wastewater, stormwater and flood protection service areas. As explained earlier, weighting of the values relative to a service area was accomplished with input from the WWT Stakeholder Group. Figures 1.3-1, 1.3-2, and 1.3-3 present the relative importance, or “weight,” that each of the six values was accorded in evaluating projects in each of the three service areas. It is notable that none of the six weights constituted an overwhelming or dominant consideration, rather that each contributed a measurable portion of the overall evaluation.

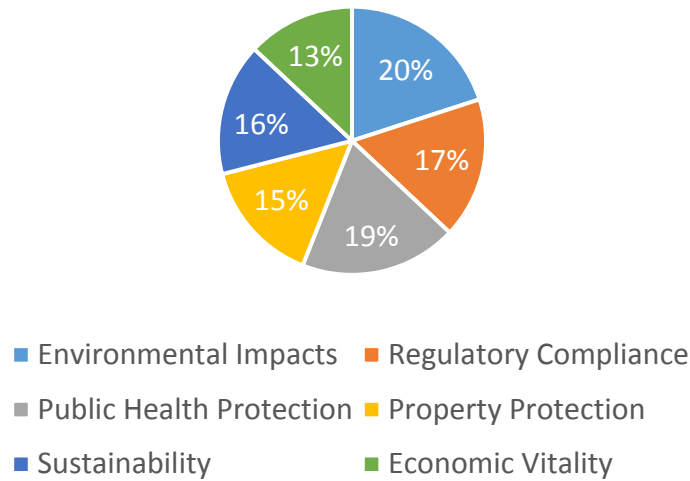
Similarly, weights were assigned to each aspect of the project-specific values reflecting the relative importance that each would have in measuring the content of a particular value for a particular service area. Since all aspects are not necessarily relevant for every service area, only those aspects that do apply were assigned a weight used to measure the value as it applies to that service area. Table 1.3-2 details the weighting assigned to each aspect of the six project-specific values relative to each of the three service areas.

### **3.3 BENEFIT/COST DETERMINATION**

Using the process described above, each project was scored for each aspect of every value. The scores from each aspect were weighted using the WWT Stakeholder Group-developed priorities, and the final total for each value was summed to create the “benefit score.” The benefit score for each project was divided by the project’s cost opinion to develop the “benefit/cost score.” The benefit/cost score

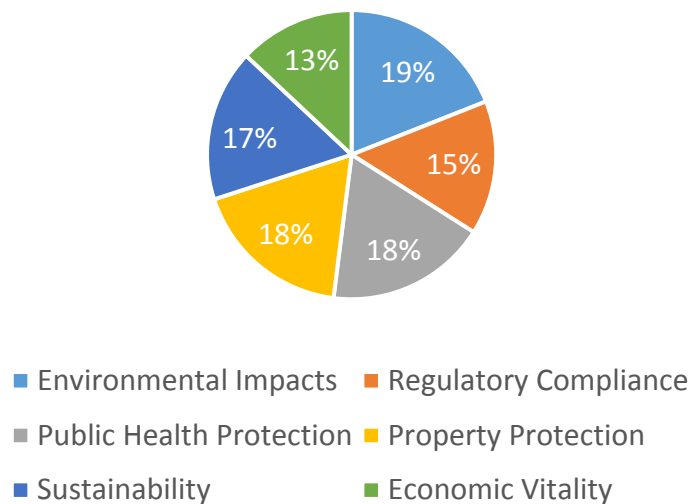
provided a quantifiable measurement of the enhancements the project would bring to the community per dollar spent. Note that the benefit/cost scores were multiplied by 1,000,000 to reflect costs in millions of dollars for ease of comparison.

**RELATIVE IMPORTANCE OF VALUES IN WASTEWATER PROJECT EVALUATION**



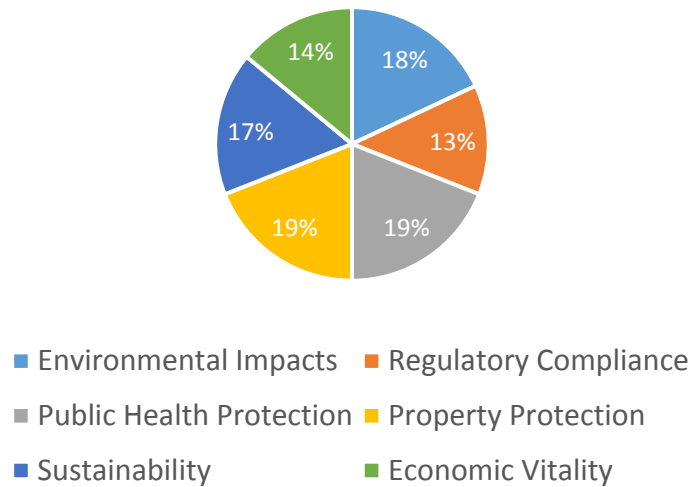
**Figure 1.3-1. Value Weighting for Wastewater Projects**

**RELATIVE IMPORTANCE OF VALUES IN STORMWATER PROJECT EVALUATION**



**Figure 1.3-2. Value Weighting for Stormwater Projects**

RELATIVE IMPORTANCE OF VALUES IN FLOOD PROTECTION PROJECT EVALUATION



**Figure 1.3-3. Value Weighting for Flood Protection Projects**

**Table 1.3-2. Weight of Aspects for Project Specific Values**

Project-Specific Values and Associated Aspects	Aspect Weight (Percent) For Service Area		
	Wastewater	Stormwater	Flood Protection
<b>Environmental Impacts</b>			
Terrestrial Habitat	10.2	10.2	14.9
Aquatic Habitat	11.4	11.4	16.7
Tree Canopy	12.0	12.0	17.6
Visual Aesthetics	10.4	10.4	15.3
Odor Aesthetics	11.7	11.7	17.1
Stream Base Flow	10.3	10.3	--
Stream Peak Flow	12.6	12.6	18.4
Nutrient Loadings	11.2	11.2	--
Impaired Use Impacts	10.3	10.3	--
<b>Regulatory Compliance</b>			
KPDES	27.5	--	--
MS4	--	32.2	--
Amended Consent Decree	30.2	34.1	37.2
Flood Plain Management	----	33.7	36.7

**Table 1.3-2. Weight of Aspects for Project Specific Values**

Project-Specific Values and Associated Aspects	Aspect Weight (Percent) For Service Area		
	Wastewater	Stormwater	Flood Protection
Air Permits	21.2	--	26.1
Biosolids	21.2	--	--
<b>Public Health Protection</b>			
Pathogen Exposure	58.0	40.7	--
Drowning Risk	--	29.8	50.3
Mold Exposure	42.0	29.5	49.7
<b>Property Protection</b>			
Basement Backup	26.5	21.7	28.1
Surface Flooding – Traffic Disruption	20.6	16.9	21.9
Surface Flooding – Structural Damage	25.3	20.8	26.9
Flood Insurance Rating	--	17.9	23.1
Public Service Delivery	27.7	22.7	--
<b>Sustainability</b>			
Non-Renewable Resource Consumption	12.4	12.4	14.4
Mechanical vs. Natural Systems	14.0	14.0	--
Multipurpose Community Asset	12.1	12.1	14.0
Public Access	11.4	11.4	13.2
Public Information/Education Enabler	11.2	11.2	13.1
Reclaim Abandoned or Under-Utilized Land	13.4	13.4	15.5
Impact on Impervious Surface	13.0	13.0	15.2
Land Use Compatibility or Improvement	12.5	12.5	14.6
<b>Economic Vitality</b>			
Number of Residential Customers	46.2	--	--
Flow/Load from Commercial/Industrial	53.8	--	--

### 3.4 INCORPORATION OF RISK REDUCTION IN PRIORITIZATION PROCESS

Projects were initially prioritized using benefit/cost score. Upon review of the project rankings, it was apparent that the values-based scoring system did not adequately account for risk-based decision making. To include risk reduction in the project selection process, an additional factor was added to the prioritization process.

Working with the WWT Stakeholder Group, the Facility Plan Team developed risk-reduction factors (RRFs) for each project. RRFs were created by assessing risk before and after a project was implemented. Risk was assessed using a traditional risk scoring matrix that rated the probability and

severity of the consequence of an event on a scale of 1 to 5 and multiplied the two ratings to come up with a score from one (low risk-low consequence) to 25 (high risk-severe consequence). See Figure 1.3-4 for an example risk-scoring matrix. As the figure below indicates, the combination of a high probability and a serious consequence result in a risk that is considered to be “critical.” The anticipated change in risk resulting from implementing a project resulted in a risk reduction factor that was used in conjunction with the benefit/cost score to prioritize projects.

<b>Consequence</b>	5	Critical	Critical	Critical	High	Medium
	4	Critical	Critical	High	Medium	Low
	3	Critical	High	Medium	Low	Low
	2	High	Medium	Low	Low	Very Low
	1	Medium	Low	Low	Very Low	Very Low
		5	4	3	2	1
		<b>Probability</b>				

**Figure 1.3-4. Value Example Risk-Scoring Matrix**

### 3.4.1 Probability of Failure

In determining the probability of failure for the risk analysis, a comprehensive condition assessment was the basis for the scores used. While each asset type had a slightly different data availability, in general they all followed this approach:

#### 3.4.1.1 Review Existing Information on Maintenance History and Previous Condition Assessments

This step included an analysis of the data available in the Hansen and SAP work order systems. This provided an initial indication of problem areas that needed detailed review. For underground pipes, the team also reviewed the compiled results of MSD’s sewer system TV inspection program. As part of the Consent Decree response MSD has done in-pipe camera assessments of over half the sewer system, prioritized by maintenance or overflow history. MSD staff have a robust pipe rehabilitation prioritization system that was incorporated into the risk management approach used for those assets.

For the ORFPS, USACE completed a Levee System Evaluation (LSE) in 2015 that included a detailed and well-documented evaluation of all components of the flood protection system. This included onsite observations, re-evaluation of the structural design of certain levee and floodwall components, and a hydraulics and hydrology evaluation of the pumping system capacity as compared to the Federal Emergency Management Agency (FEMA) minimum standards.

#### 3.4.1.2 Staff Interviews

The Facility Plan team interviewed maintenance staff who have primary responsibility for the facilities in question. These interviews included a review of the initial conclusions drawn from the previous data review and gained additional insight into areas that needed more detailed assessment.

### **3.4.1.3 Physical Observation**

The Facility Plan team physically evaluated the entire 29.5 miles of floodwall and levee, and all 16 FPSs. This evaluation confirmed the findings of the USACE 2015 LSE, and provided additional review of other conditions of concern to MSD that did not fall under the scope of an LSE. The team also observed portions of the drainage system, particularly those including pumping or other mechanical systems.

The Facility Plan Team also physically evaluated all five WQTC and several FPSs identified through staff interviews as a representative sampling of potentially problematic facilities. The physical evaluations included a review of the facility process equipment including observed physical condition, equipment performance compared to rated capacities, and age since installation or rebuild compared to normal service life for equipment of that type.

Special attention was given to some of the facilities of the Morris Forman WQTC that were potentially damaged by the 2015 internal flooding event. For these assets, the Facility Plan Team employed nondestructive testing of process equipment, including measurements of temperature of a select sampling of critical components running at load (for example, electrical gear, bearings). The Facility Plan Team also measured vibration of this rotating equipment under varying load conditions. The condition assessment quantification of the Morris Forman WQTC assets was performed using the CH2M tool called Asset Condition Evaluation System (ACES). ACES is a web-based data management tool that allows the inspector to answer condition criteria questions pertaining to specific asset types. The scoring system for the condition assessment follows the International Infrastructure Management Manual (IIMM) for condition assessment. In addition to answers to condition criteria questions for each asset, ACES also provides an estimate of the remaining life of each asset, based on the asset's current condition and the typical life of the asset.

For buildings and other above ground facilities approximately 200 facilities were visually evaluated using the procedures outlined in ASTM E 2018 *Standard Guide for Property Condition Assessment*. This included detailed evaluations of the roof, electrical system, plumbing, fire alarm, fire sprinkler systems and life safety equipment. Deficiencies were ranked based on severity and consequence of failure, per ASTM E 2018. If potential structural deficiencies were noted, these were subject to a follow-up inspection by a licensed structural engineer. The structural engineering review included a confirmation of the severity of the condition, and conceptual plans and cost estimates for repairing those structural conditions that had the potential for failure.

### **3.4.2 Consequence of Failure Analysis**

Risk mitigation effectiveness was valued based on the change in either the probability of an event happening or the consequence of that event if it does occur. For the wastewater system the consequence of failure analysis considered the population of an impacted area, the potential impact on MSD regulatory compliance and the potential impact on the environment. For Ohio River flood protection and interior drainage systems the consequences of failure that were evaluated were the population of the potential impacted area and the property and structure values of the areas that could be inundated in a flood event. Impacts on transportation and the environment were also considered. For building systems, the consequences of failure were related to the health and safety of MSD

employees, the potential for loss of facility reliability, and the increased cost of repair or replacement if corrective actions are not taken.

### **3.4.3 Scoring Approach**

Under this scoring system the consequence of an event typically could not be changed as a project would not change the number of people in an area or the location of sensitive environments. Implementing a project was usually intended to reduce the probability of an event. For example, an expanded FPS would be able to manage the flows from a larger rain and thus reduce the likelihood that homes in a watershed would be flooded.

The difference in the risk score before and after a project was converted to RRFs. Because the maximum risk score reduction that could be achieved was 20, projects that reached that level of risk reduction were given an RRF of 2. The lowest reduction possible was a 1 and this was assigned an RRF of 1. Risk reduction scores between 20 and 1 were given RRFs proportionally between 1 and 2 (that is, a risk score reduction of 15 would receive an RRF of 1.5).

The benefit/cost score was multiplied by the RRF to get the “prioritization score.” Projects were then ranked by the prioritization score as they provided the highest benefits to the community and most risk reduction at the lowest costs.

### **3.5 APPLICATION OF BEST PROFESSIONAL JUDGEMENT**

To verify the validity of the results of the prioritization, the Facility Plan Team reviewed the proposed project prioritizations and applied best professional judgement to adjust the project rankings. Numerous considerations were considered and used in a standardized method to ensure that projects were treated consistently across service areas. In general, the following types of projects were considered exempt from being scheduled using the prioritization system because they were associated with specific needs that would need to be addressed at certain times, and thus should be included in the CIP in sequence with those schedules:

- Equipment replacements
- Annual allocations
- Regulatory driven projects (including IOAP commitments)
- Asset maintenance
- System expansions to meet population projections

Additionally, floodwall, levee, and projects in the property service area were developed to deliver the lowest life-cycle cost and needed to be initiated at certain times to be successful. Impacts to the community were also incorporated so that nearby projects could be done concurrently to reduce the duration of construction. Last, some projects’ schedules needed to be adjusted to allow for a logical sequencing of work so that implementing one project does not cause a strain on facilities in another area until a following project is complete. The more efficient method would be to build the projects in

an order that does not stress the system. An example of this order would be to expand downstream sewers before increasing capacity upstream.

### **3.6 ADAPTIVE MANAGEMENT**

#### **3.6.1 Purpose**

The Facility Plan includes recommendations for both capital and operating programs to be implemented over the next 20 years. While this plan was developed by a team of highly experienced engineers and carefully vetted with MSD staff and MSD customers, the recommendations represent a “snapshot in time” using the best information available when the analyses were completed. Over the course of Facility Plan implementation, facility and regulatory conditions are expected to change, new information become available, and MSD’s ongoing community outreach program better identify neighborhood concerns that affect individual projects.

To adapt to these changed conditions, an adaptive management approach to Facility Plan implementation is recommended and includes the following major components:

- Post-construction performance monitoring to determine whether projects are meeting their individual project goals and, where appropriate, determine whether the overall system performance is achieving the intended functionality and reliability, and report to the community on how their infrastructure investments are being used.
- Annual CIP review as part of annual budgeting where each project planned to start over the next 5 years will have its priority reconsidered and compared with new project needs identified over the previous year, resulting in an overall CIP revision that meets current and short-term projections of future needs.
- Comprehensive update of the Facility Plan at 5-year intervals, reviewing progress to date, changes in assumptions and new information, and extending the scope of the plan to cover an additional 5 years (keeping it a 20-year look-ahead).

Section 3.6.2 describes the recommended overall approach to each major component.

#### **3.6.2 Post-Construction Performance Monitoring**

During MSD’s “community conversation” about the Facility Plan, many questions were asked that related to MSD’s accountability for using rate-payer’s money wisely. While many Facility Plan projects are not required by any specific regulation, the community asked for ongoing communications about how MSD is implementing Facility Plan projects and programs. The accountability elements of the IOAP dictated by the ACD served as a general guideline for the recommended approach to accountability. The IOAP post-construction compliance monitoring program includes the following elements that apply the Facility Plan post-construction performance monitoring program:

- Develop project-specific and overall system performance expectations.

- Document project performance through construction contractor acceptance testing, specific testing to ensure design intent is met, and initial operating data review.
- Annually assess systemwide or subsystem performance affected by new projects, identifying areas of performance deficiency (if any) and developing mitigation actions including new projects if needed.
- Regularly communicate progress and performance, including the following:
  - Quarterly reports to the Executive Director and Infrastructure Committee
  - Semiannual reports to the full MSD Board
  - Annual reports to stakeholders

While this performance monitoring program does not have the same legal standing as the IOAP post-construction compliance monitoring program, the approach should be sufficiently rigorous and transparent to assure the community that progress is being made and their money is being spent wisely.

### **3.6.3 Annual Capital Improvement Plan Review**

MSD's annual budget development process already involves reviewing proposed projects (either in the current CIP or initiated in response to identified needs) and prioritizing projects to fit available funding. The current MSD prioritization process includes three general categories:

- Priority 1 are required projects such as ACD/IOAP projects, USACE flood protection system requirements, code compliance, health and safety concerns (MSD staff and general public).
- Priority 2 are "must do" projects that are considered mission critical to mitigate infrastructure failure risks where no contingency work-arounds are available.
- Priority 3 are "should do" projects that affect mission-critical facilities or systems, but temporary work-arounds are available to mitigate the consequences of infrastructure failure.

MSD has been using this priority system for several years, in an interactive project prioritization exercise involving Engineering and Operations staff.

In addition to the CIP prioritization system, MSD has a *Policy on Design of Stormwater Capital Projects* adopted by the MSD Board July 11, 1994. This policy states that drainage project prioritization should consider the following factors, in this order:

- Eliminate or reduce flowing (flooding?) with risk of personal injury.
- Eliminate first-floor flooding.
- Eliminate or reduce basement flooding.
- Provide outlet for drainage from a critical upstream project.
- Eliminate or reduce flowing that interferes with transportation of priority access roads to neighborhoods.
- Control erosion where structures or property is being damaged or erosion is occurring outside defined easements.

- Eliminate long-term standing water that occurs outside a defined easement.
- Eliminate erosion within a defined easement.
- Eliminate long-standing water due to lack of an outlet within an easement.

This policy should be used to prioritize drainage projects and should be incorporated into the Stormwater Master Plan (SWMP) recommended by the Facility Plan.

The Facility Plan has defined a long list of recommended projects, with recommended priorities established through a benefit/cost and risk reduction analysis. As noted previously in Section 3.3, the priorities are based on the benefits of protecting public health, protecting the environment, ensuring regulatory compliance, protecting property, incorporating sustainable solutions, and promoting economic vitality. The process also developed specific risk-reduction factors described in Section 3.4, which were used to modify the benefit/cost scores when significant risks were identified related to the project. The specific prioritization scoring for recommended projects is documented in Volumes 2, 3, 4, and 5. The score sheets have also been provided electronically for MSD's use.

The annual CIP budgeting process is recommended to follow these steps:

- For ACD/IOAP projects regardless of status, confirm the estimate to complete and the required schedule to complete with the project manager and confirm the anticipated cash flow; these are commitments that cannot be changed through the annual budgeting process.
- For projects currently under contracts for construction, verify the estimated costs to complete and schedule to complete with the project manager, and adjust the CIP budget and cash flow if needed; these are commitments that should not be changed except under extremely unusual circumstances.
- For projects under design, verify the estimated costs to complete, anticipated schedule to complete, and any new information the project manager has regarding cost-sharing with public or private partners and/or grants received; in most cases, these projects will proceed per the current schedule, but projects under design are subject to reprioritization, especially if funding is limited.
- For Facility Plan projects not yet started, review any new information regarding costs, benefits, or risks, and confirm that the scheduled starting dates are consistent with revised project prioritization information.
- For new projects not addressed by the Facility Plan, develop fact sheets with the same information contained in the Facility Plan fact sheets, and prioritize these projects in comparison to the other projects currently in the budget.
- Roll-up the preferred project schedule cash flow and compare with the CIP available funding provided by the Finance Division; identify shortfalls, if any, over the 5-year short-term planning window.
- Trend project spending by enterprise fund type (wastewater or drainage) and identify long-term inconsistencies between revenue and expenditures within these funds.

- Assess project spending across the six identified risk areas, and adjust project schedules if needed to provide adequate consideration of all the risks:
  - ACD compliance
  - Wastewater treatment facilities
  - Aging infrastructure, including MSD’s underground pipe systems and aboveground facilities and structures
  - Ohio River flood protection
  - Viaduct flooding
  - Neighborhood drainage and inland flooding of roads and structures
- Move projects within the CIP considering the existing MSD Priority 1, 2, 3 system, and the *Policy on Design of Stormwater Capital Projects* (If applicable) to fit the funding available for each year within the 5-year planning period.
- Document the CIP development process in a trackable, transparent format.

The resulting CIP will represent the best information available to guide MSD’s project implementation for the next FY.

#### **3.6.4 Comprehensive Update of the Plan**

While annual CIP updates represent a short-term look at MSD’s project needs, the Facility Plan represents a comprehensive look at 20-year needs. The Facility Plan Team recommends that this long-term look be updated at 5-year intervals to revisit the following issues:

- Changes to the status of proposed regulations
- Updates to facility condition assessment or infrastructure failure incidents
- Changes in population, population distribution, and land use planning
- Significant input resulting from MSD’s ongoing community outreach program
- Updates to the cost of service analysis and optimum rate structure and classes

The first update, scheduled to start in FY2020 and be completed in FY2021, should also incorporate the recommended SWMP, which should be complete by that time.

## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 4 RECOMMENDED CAPITAL IMPROVEMENT PROJECTS

#### 4.1 20-YEAR COMPREHENSIVE FACILITY PLAN RECOMMENDED PROJECTS

Proposed capital improvements are organized into drainage, wastewater, and property sections. Drainage projects include stormwater improvements to reduce nuisance ponding, mitigate flooding, protect against Ohio River and interior flooding, and enhance water quality in Jefferson County. Sewer system projects include projects related to the collection, conveyance, and treatment of sanitary and combined wastewater. Projects related to MSD’s ACD are addressed separately in Section 4.1.2. All costs and totals presented in this chapter are in escalated costs (from 2016 dollars) using a 3-percent inflation factor.

##### 4.1.1 Recommended Stormwater and Drainage Capital Projects

As part of Facility Plan development, previous drainage studies and planning were reviewed. The Facility Plan Team concluded that MSD had successfully executed the vast majority of the projects identified previously and had shifted its focus to resolving smaller, neighborhood- to site-level drainage issues. To respond to changes in land use, development, and extreme storm frequency in a holistic manner, the Facility Plan Team recommended a watershed-scale SWMP to address stormwater and drainage needs across Jefferson County. The SWMP will identify larger-scale improvements to MSD’s drainage system that are recommended for completion in the first 5 years of the Facility Plan. Following are other recommendations from the Facility Plan:

- **SWMP**—The recommended 5-year CIP includes \$4 million to develop a detailed master plan to direct long-term improvements to Louisville’s drainage system. The SWMP will develop holistic, watershed-based solutions to address lingering issues and prepare the system for increased frequency of extreme storm events. A total of \$887 million has been identified to implement recommendations from the SWMP within the recommended 20-year CIP.
- **Project DRI**—Project DRI was developed to address Louisville’s problematic drainage areas. This highly successful program has eliminated a significant backlog of issues and continues to be a critical component of the overall drainage program. As a mature program, projects tend to be smaller and focused on resolving repeat problem areas. The Facility Plan Team recommends \$133 million to continue this program.
- **Flood response**—MSD has been successful at leveraging funding from the federal government, particularly FEMA, to remove homes and businesses from the floodplain. This is often substantially more cost-effective than infrastructure solutions and provides a higher level of protection. A total of \$108 million has been recommended to support grant coordination and administration, local share contributions, and flood-proofing.

- **MS4 Program**—Discharges from storm sewer systems in metropolitan areas are permitted under the MS4 permit. This permit sets “maximum extent possible” (MEP) requirements that MSD must perform to mitigate pollution of waters from stormwater discharges. The requirements of this permit are expected to grow in scope and scale in the next 20 years. To meet these anticipated new standards, capital projects in the form of retrofits to the existing system, systems to remove pollutants from stormwater, green infrastructure installations, greater public outreach and education, and additional support will be needed. The recommended 20-year CIP includes \$77.5 million to support this program.
- **Basin retrofit projects**—These projects will modify existing stormwater basins to infiltrate water into the ground and remove pollutants before discharging to community streams. These retrofits will improve the functionality of the basins both in runoff flow reduction and runoff water quality. These projects are included in the recommended 20-year CIP with a total cost of \$1.8 million.
- **Viaduct flooding solutions**—Numerous viaducts in MSD’s service area can become inundated during heavy rains leading to transportation disruptions and potential dangers to residents. Conceptual solutions have been identified to address problematic viaducts through improvements to the existing drainage system. These projects total \$401 million in the recommended CIP.

#### **4.1.2 Recommended Stormwater and Drainage Renewal and Replacement Projects**

A key focus of the Facility Plan is to enhance MSD’s asset management program by formalizing a proactive renewal and replacement component. Within MSD’s drainage system, this is most applicable to the ORFPS, which consists of the floodwalls, levee, and flood pump stations. Total ORFPS capital expenditures in the next 20 years are recommended to be \$683 million and include the following:

- **Floodwall and levee projects**—MSD is responsible for O&M of the 29 miles of floodwall and levee that protect Louisville from flooding from the Ohio River. Maintaining the integrity of this system is critical to preventing a catastrophic loss of life and/or property. USACE recently evaluated MSD’s flood protection system, and found that the floodwalls and levee meet all applicable requirements. As the floodwall and levees have been constructed and are not anticipated to need to be expanded, the focus is on continued renewal and replacement. Annual budget allocations have been proposed to keep the system operable and reliable by repairing and/or replacing gates, closures, and panels; keeping the levee free of encroachments and settlement; improving the efficiency of the system; and providing additional risk assessments to identify critical areas. During the next 20 years, these recommended projects and allocations total \$64 million.
- **FPSs**—MSD’s 16 FPSs pump stormwater drainage from the interior of the service area into the Ohio River when the river’s elevation requires the floodwall and levees to be sealed. A total of 10 of the 16 stations were constructed in the 1950s and still contain equipment from the original construction. At the same time, changes in land use, development, and the increased frequency of extreme storms are creating the need for the stations to pump at higher capacities

in the future. To prepare for this, projects have been developed to renovate, expand, and/or improve all flood-pumping stations to meet the anticipated needs in 2035. A total of \$574 million has been proposed for the next 20 years for the implementation of these projects.

#### **4.1.3 Recommended Wastewater Capital Projects**

In response to the 2005 Consent Decree, MSD prepared the IOAP. Since the IOAP was approved in 2009, MSD's focus has been on implementing the projects outlined in the IOAP. To continue to meet the level of performance required by the Consent Decree, additional capital improvements will be necessary after the IOAP is completed. At the same time, changes in regulations, opportunities for enhanced efficiencies, and the evolving needs of the community require capital investments that have been documented by the Facility Plan. A summary of key projects planned or already underway include:

- **System expansion**—To meet the needs of a growing community, projects have been defined to expand sanitary sewers to developed areas without sewers and undeveloped areas that are expected to grow. The costs of development-related projects would be offset through capacity development charges, system development surcharges, excess cost programs share, or will recoup expenses over time. This also includes land acquisitions to provide space to expand WQTCs as necessary to increase capacity.
- **System redundancy**—As the wastewater flows and loads increase over time, the importance of fully functional infrastructure increases. To this end, critical pump stations and treatment processes have been identified that must maintain a minimum level of performance at all times. To achieve this level of performance, improvements have been developed to provide secondary power, redundant systems, or backup equipment for these key pieces of equipment throughout the service area.
- **System resiliency**—The increased frequency of extreme storm events puts the functionality of sewer systems at a higher risk of being inundated and thus inoperable or possibly permanently damaged. Assets potentially vulnerable to being impacted by rising floodplains have been determined and budgets established to mitigate the risks to them.
- **System efficiency**—As part of the extensive review of MSD's sewer system by the Facility Plan Team, opportunities to enhance efficiencies were discovered. The elimination of pump stations, replacement of inefficient processes, and installation of automated systems will eventually repay the initial costs in O&M savings.

A total of \$1.265 billion has been included in the recommended CIP to implement the projects listed herein (not including the IOAP Consent Decree projects addressed later). Additionally, needs have been identified that are beyond the 20-year planning horizon of the recommended CIP but have been documented for long-term planning needs. These are primarily related to expected changes in regulations and permits that will require higher levels of nutrient treatment, the removal of microconstituents (such as, personal care chemicals and pharmaceutical traces), and the eventual replacement or reconfiguration of the Morris Forman WQTC, MSD's largest and most valuable asset. The complete replacement or reconfiguration of the Morris Forman WQTC is not anticipated to be required

during the 20-year planning horizon of the Facility Plan, but a recommended road map to stepwise implementation will allow MSD to make short-term improvements that are consistent with the long-term vision for this facility.

#### **4.1.4 Recommended Wastewater Renewal and Replacement Projects**

A substantial portion of the Facility Plan’s sewer system recommendations are focused on the timely, proactive renewal and replacement of assets to allow for the continued operation of the system at a high level of performance. Specific recommendations and budgets have been established to create projects, including the following:

- **WQTC equipment renewal and replacement**—To plan and implement an orderly renewal and/or replacement of equipment at MSD’s five regional WQTCs that does not disrupt operations, projects have been created to address equipment needs in 5-year intervals. This will allow for a phased approach to minimize stress on the treatment process while making certain that critical assets are replaced and renewed before their useful life is exhausted. A total of \$214 million has been included in the recommended CIP for these projects.
- **Pump replacement program**—The majority of MSD’s pump stations are smaller stations intended to serve a limited area. Rather than allow these pumps to run to failure, guidelines for the proactive replacement of pumps before they exhibit deteriorated performance have been established and a budget determined for implementation. This will remove a substantial maintenance burden on staff to keep aged pumps operating. Funding for this program is included in the recommended 20-year CIP for a total of \$8.7 million.
- **Major interceptor rehabilitation**—The backbone supports of MSD’s wastewater collection system are the larger-diameter sewers that transport wastewater to the five regional WQTCs. Some interceptors that date back to the Civil War period are made of outdated materials, such as dry-laid brick, and are in highly developed, urban areas, which make maintenance activities challenging. MSD has recently completed the internal condition assessment of many of the major interceptors. A program has been proposed to begin systematically rehabilitating this infrastructure over time, using risk-based criteria to prioritize improvements helping to ensure continued operation for the next 100-plus years. Implementation of this program is recommended with a proposed budget of \$231 million.

#### **4.1.5 Recommended Property and Support Systems Capital Projects**

The Facility Plan completed inspections of 178 facilities, including sanitary and storm pump stations, flood pump stations, WQTCs, flood closure storage vaults, CMF, and the main office building. Projects were identified to address safety issues, code compliance, and to deliver the lowest life-cycle costs for property, buildings, and facilities. Projects from this service area include the following:

- **Roof repair and replacements**—A significant portion (estimated at 95 percent) of the roofs that MSD is responsible for are in a deteriorated condition. Not addressing these conditions in a timely manner will result in complete failure of the roofing system that could lead to substantial

damages and impact operations. Roofs are seldom replaced until a leak is detected inside the building. The Facility Plan recommends an extensive program of roof replacement in the first 5 years, using standardized roofing systems for different applications. After that, regular inspection and replacement before failure occurs is recommended to provide the minimum cost of ownership for the buildings protected by these roofs. The recommended 20-year CIP includes \$12 million to repair, replace, and maintain roofs over the 20-year planning window.

The Facility Condition Assessment also identified a number of deficiencies in areas related to heating, ventilation, and air conditioning (HVAC), building egress, signage and safety equipment, and indications of conditions that could eventually cause structural issues, and even structural failure. The recommended 20-year CIP includes projects to address the specific recommendations identified by the Facility Plan Team, with future budgets recommended to complete periodic condition assessments following deficiency correction.

- **Lead paint and mold abatement**—Numerous instances of lead paint and mold were identified through the inspections. The safe removal of these contaminants will protect the health and safety of MSD staff and allow previously unusable areas to be occupied again. Projects recommended to address these issues total \$600,000.
- **Structural**—Many of the structures MSD owns are decades-old and are showing signs of deterioration in the walls and foundations. Addressing these defects in a timely manner is more cost-effective and safer than running to failure. Projects totaling \$0.7 million are recommended to address poor conditions and maintain structures.
- **Capital equipment**—MSD owns or leases more than 600 vehicles and portable equipment, ranging from passenger vehicles and pick-up trucks to large excavators and sewer cleaning trucks. MSD is investigating the potential for leasing additional commonly available passenger cars and pick-up trucks, which would move these costs from capital to operating budgets. The specialty equipment used in MSD’s O&M activities may not be available for lease, and MSD should continue to own them to be certain they are available any time they are required. This equipment is critical to MSD’s ability to complete the preventive and corrective maintenance activities required to provide sustainable and reliable wastewater, stormwater, and flood protection services. For example, a comprehensive sewer inspection activity requires a sewer flush truck to clean the sewer, a Vactor truck to capture the material flushed from the line to prevent it from moving downstream to cause problems elsewhere, and a closed-circuit television (CCTV) truck to take a close look at the pipe condition. After the condition is established, either heavy construction equipment like excavators and loaders or specialty equipment to install cured-in-place sewer lining is used to correct deficiencies. The specialized equipment is very expensive to purchase and maintain, given the severe service conditions that this equipment is operated under. The recommended 20-year CIP includes an annual allowance for repair and replacement of this equipment.
- **Information technology (IT) systems and Louisville/Jefferson County Information Consortium (LOJIC) support**—MSD maintains an extensive inventory of IT hardware and software that is essential to the overall operations of the agency. This includes the MSD internet system that is

the backbone of MSD electronic communication and digital data generation, communication and storage. It also includes the MSD supervisory control and data acquisition (SCADA) system that controls approximately 300 pump stations and control gates. It is also the platform for implementation of the RTC system used to optimize use of MSD's conveyance facilities to cost-effectively maximize the use of existing facilities to reduce sewer overflows. Without adequate and updated IT systems, public health and safety could be at risk. This inventory is subject to periodic upgrade and replacement like all MSD's other assets. In addition, MSD hosts the LOJIC systems which similarly require periodic upgrades and replacements to hardware and software. The recommended 20-year CIP includes annual allowances to account for these anticipated future costs.

#### **4.2 AMENDED CONSENT DECREE-RELATED PROJECTS**

Following are ACD-related projects:

- **IOAP**—Developed in response to the 2005 Federal Consent Decree, the IOAP created the framework for a 19-year program to manage and mitigate CSOs to a defined level of control, and eliminates sanitary sewer overflows (up to a certain storm event). In 2009, the Consent Decree was amended to address recordkeeping and WQTC bypasses and treatment performance. The IOAP has been incorporated into the Facility Plan. Key capital projects from the IOAP include the following:
  - **CSO storage basins**—Large storage basins are under design or construction at strategic locations in MSD's combined sewer system (CSS) to temporarily store flows during rain events. When capacity is available, these stored flows will be released back into the collection system for treatment. These basins are a foundation of MSD's CSO control strategy and must be operational by state- and federally enforced deadlines.
  - **Green infrastructure projects**—Green infrastructure works by capturing stormwater runoff in natural systems before it can enter the CSS and thus reducing the potential for overflows from the system. Additionally, these systems remove pollutants through natural filtration systems so that any flows that must pass through them carry a reduced pollutant load. MSD is committed to integrating green infrastructure as part of its overflow control strategy, and has implemented an innovative system of cost-sharing with other public agencies and private developers to leverage MSD's investment in green infrastructure to the extent it furthers MSD's service offerings.
- **CMOM Projects**—An essential component to the long-term success of the IOAP is an effective CMOM program that makes sure the wastewater collection system operates effectively. Elements of this program include capital investment, sewer inspection and cleaning, repair of defects found in sewers, and removal of illicit and illegal connections to the system.
- **NMC Projects**—The NMC principles related to optimizing operation of the CSS will remain in full force and effect, with the enforcement mechanism shifted from the ACD to the Morris Forman WQTC discharge permit. One critical item that will live on after the IOAP is completed is the



continued implementation and optimization of MSD's RTC system that maximizes storage in the collection system through a series of automated dams and gates.

#### **4.3 TOTAL PROPOSED CAPITAL IMPROVEMENTS**

The Facility Plan scope was developed to identify long-term capital project needs and associated operating costs to improve and sustain the sewer, stormwater management, and Ohio River flood protection systems. The projects and programs required by the ACD are required to be completed. Other projects needed for compliance with applicable regulations are similarly required to be completed, even though funding is not included in current approved CIP budgets. Some of the recommendations of the Facility Plan are not required by regulations, but are based on the community's desire for sustained reliability of service and improvements in the level of protection provided for stormwater drainage, floodplain management, and Ohio River flood protection. Implementation of these projects and programs depend on the community's willingness to fund the improvements. The Facility Plan recommendations represent a road map to achieve a reliable and consistent level of service across the county for all MSD's service offerings. The actual timing of recommended actions will be determined by the availability of funds to complete them. Table 1.4-1 summarizes the planned capital expenditure across each budget category and year. Detailed project lists, schedules, and budgets are included in their respective volumes.



**Table 1.4-1 Facility Plan CIP Recommendation Summary (in millions of dollars)**

Program	System	Fiscal Year																				Total
		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	
ACD (IOAP)	Wastewater	\$109.9	\$139.5	\$154.4	\$89.7	\$71.1	\$13.3	\$8.5	\$4.3	\$.2	\$.2	\$.2	\$.2	\$.0	\$.0	\$.0	\$.0	\$.0	\$.0	\$.0	\$.0	\$591.5
NMC	Wastewater	\$19.7	\$21.3	\$25.9	\$26.7	\$22.6	\$6.3	\$6.4	\$6.6	\$6.8	\$7.0	\$6.6	\$6.8	\$7.0	\$7.2	\$7.4	\$7.6	\$7.7	\$8.0	\$8.5	\$8.5	\$224.5
CMOM	Wastewater	\$18.6	\$25.1	\$24.1	\$35.7	\$40.7	\$59.7	\$53.3	\$54.3	\$54.5	\$54.0	\$37.8	\$35.0	\$36.1	\$37.2	\$38.3	\$40.0	\$37.9	\$39.0	\$44.0	\$44.0	\$805.4
Development	Wastewater	\$2.6	\$2.2	\$5.6	\$9.0	\$3.6	\$11.5	\$18.1	\$14.8	\$7.5	\$5.0	\$19.5	\$27.0	\$35.2	\$28.7	\$23.3	\$4.1	\$4.2	\$4.3	\$4.6	\$4.6	\$235.2
<b>Total Wastewater</b>		<b>\$150.8</b>	<b>\$188.1</b>	<b>\$210.0</b>	<b>\$161.1</b>	<b>\$138.0</b>	<b>\$90.8</b>	<b>\$86.3</b>	<b>\$80.1</b>	<b>\$68.9</b>	<b>\$66.2</b>	<b>\$64.1</b>	<b>\$69.1</b>	<b>\$78.3</b>	<b>\$73.1</b>	<b>\$69.0</b>	<b>\$51.6</b>	<b>\$49.8</b>	<b>\$51.3</b>	<b>\$52.8</b>	<b>\$57.0</b>	<b>\$1,856.5</b>
Drainage	Stormwater	\$4.2	\$16.2	\$31.8	\$59.7	\$77.9	\$63.8	\$82.9	\$85.4	\$87.9	\$83.0	\$74.2	\$76.4	\$78.7	\$81.1	\$83.5	\$94.2	\$97.0	\$109.5	\$116.2	\$116.2	\$1,516.5
Floodplain Management	Stormwater	\$1.6	\$4.6	\$4.4	\$4.5	\$4.6	\$4.8	\$4.9	\$5.1	\$5.2	\$5.4	\$5.5	\$5.7	\$5.9	\$6.1	\$6.2	\$6.4	\$6.6	\$6.8	\$7.2	\$7.2	\$108.6
Ohio River Flood Protection	Stormwater	\$11.4	\$18.3	\$25.6	\$26.8	\$46.0	\$29.0	\$29.8	\$41.5	\$42.8	\$32.6	\$28.7	\$29.6	\$43.0	\$44.3	\$45.6	\$23.0	\$23.7	\$32.1	\$34.0	\$34.0	\$640.9
Stormwater Quality (MS4)	Stormwater	\$1.9	\$1.7	\$1.9	\$1.9	\$3.7	\$3.3	\$4.0	\$4.1	\$4.2	\$4.3	\$4.1	\$4.2	\$4.3	\$4.4	\$4.6	\$4.7	\$4.8	\$5.0	\$5.3	\$5.3	\$77.5
<b>Total Stormwater</b>		<b>\$19.1</b>	<b>\$40.8</b>	<b>\$63.7</b>	<b>\$93.0</b>	<b>\$132.3</b>	<b>\$100.7</b>	<b>\$121.6</b>	<b>\$136.0</b>	<b>\$140.1</b>	<b>\$125.3</b>	<b>\$112.5</b>	<b>\$115.9</b>	<b>\$131.9</b>	<b>\$135.9</b>	<b>\$140.0</b>	<b>\$128.3</b>	<b>\$132.2</b>	<b>\$153.4</b>	<b>\$158.0</b>	<b>\$162.7</b>	<b>\$2,343.4</b>
Capital Equipment	Support Systems	\$.6	\$1.4	\$1.9	\$2.4	\$5.0	\$2.8	\$2.9	\$2.9	\$3.0	\$3.1	\$3.2	\$3.3	\$3.3	\$3.4	\$3.5	\$3.6	\$3.7	\$3.8	\$4.0	\$4.0	\$61.8
Facilities	Support Systems	\$10.2	\$3.1	\$4.7	\$4.2	\$5.7	\$2.0	\$2.6	\$1.1	\$.7	\$1.9	\$.6	\$.6	\$.6	\$.6	\$.9	\$.5	\$.5	\$.5	\$.6	\$.6	\$41.9
IT	Support Systems	\$1.6	\$.7	\$.3	\$.3	\$.3	\$.7	\$.7	\$.8	\$.8	\$.8	\$.6	\$.6	\$.6	\$.6	\$.7	\$.7	\$.7	\$.7	\$.8	\$.8	\$13.6
LOJIC	Support Systems	\$.1	\$.4	\$.1	\$.5	\$.3	\$.5	\$.2	\$.5	\$.2	\$.5	\$.2	\$.6	\$.2	\$.6	\$.2	\$.6	\$.2	\$.7	\$.3	\$.3	\$7.3
<b>Total Support Systems</b>		<b>\$12.5</b>	<b>\$5.5</b>	<b>\$7.0</b>	<b>\$7.4</b>	<b>\$11.2</b>	<b>\$6.0</b>	<b>\$6.4</b>	<b>\$5.3</b>	<b>\$4.7</b>	<b>\$6.3</b>	<b>\$4.5</b>	<b>\$5.0</b>	<b>\$4.8</b>	<b>\$5.3</b>	<b>\$5.3</b>	<b>\$5.4</b>	<b>\$5.2</b>	<b>\$5.7</b>	<b>\$5.5</b>	<b>\$5.6</b>	<b>\$124.5</b>
<b>Total Facility Plan</b>		<b>\$182.4</b>	<b>\$234.5</b>	<b>\$280.7</b>	<b>\$261.4</b>	<b>\$281.5</b>	<b>\$197.5</b>	<b>\$214.3</b>	<b>\$221.3</b>	<b>\$213.8</b>	<b>\$197.8</b>	<b>\$181.2</b>	<b>\$190.0</b>	<b>\$215.0</b>	<b>\$214.3</b>	<b>\$214.3</b>	<b>\$185.4</b>	<b>\$187.2</b>	<b>\$210.5</b>	<b>\$216.3</b>	<b>\$225.3</b>	<b>\$4,324.5</b>

## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 5 SCHEDULE

#### 5.1 CRITERIA AND BOUNDARY CONDITIONS

One of the main purposes of this Facility Plan is to consolidate the activities of the wastewater, stormwater, Ohio River flood protection, and property and support facilities systems. A consolidated schedule allows the development of overall resourcing plans (both financial and staffing). In developing the consolidated schedule, the following boundary conditions were recognized:

- Project schedules for IOAP projects are part of MSD’s ACD and are not subject to change without the expressed concurrence of EPA and the Kentucky Department of Environmental Protection (KDEP). For this reason, all IOAP projects were scheduled as presented in the 2012 Modification of the IOAP.
- Project prioritization was developed using the criteria and approach described in Volume 1, Chapter 3. Professional judgement was also applied to the prioritization scoring to account for the following over-riding factors:
  - Projects already under design or construction, or scheduled to start as part of the approved FY2017 budget, were assumed to continue to completion as currently planned.
  - Projects closely aligned with related projects of a higher priority were “bundled” with the highest priority project on the assumption that costs could be reduced in consolidated projects.
  - Projects tied to regulatory requirements or MSD commitments to provide service were scheduled at the times necessary to meet these requirements or commitments.
  - Asset renewal and replacement projects were scheduled at regular intervals (typically annually or at 5-year intervals) as part of a “best practices” asset management approach.
  - Annual service contracts that support the capital program (such as radar rainfall, stream monitoring, and technical support for development reviews) were included as annual capital expenditures.
- Projects were spread uniformly over the 20-year planning period, with the assumption that MSD would complete the recommendations of the 20-year Facility Plan during that same time period. This assumption is based on MSD’s ability to obtain approvals for the rate increases needed to fund this program. If funding limitations preclude finishing all the recommendations in the 20-year time period, it is assumed that MSD will reprioritize projects by considering both the priorities established in the Facility Plan and other information developed subsequent to publication of this plan.

## 5.2 SCHEDULE

The schedule shows the period of significant capital spending (assumed to be the construction period in most cases) but does not represent a full project duration to address site investigations, land and easement acquisition, preliminary and final design, or project bidding. To achieve project completion in accordance with the project schedule, the site investigation and engineering portions of the project could require a start 1 to 2 years before the initiation date shown. A more detailed schedule and project execution plan should be developed as part of the handover from planning to design.

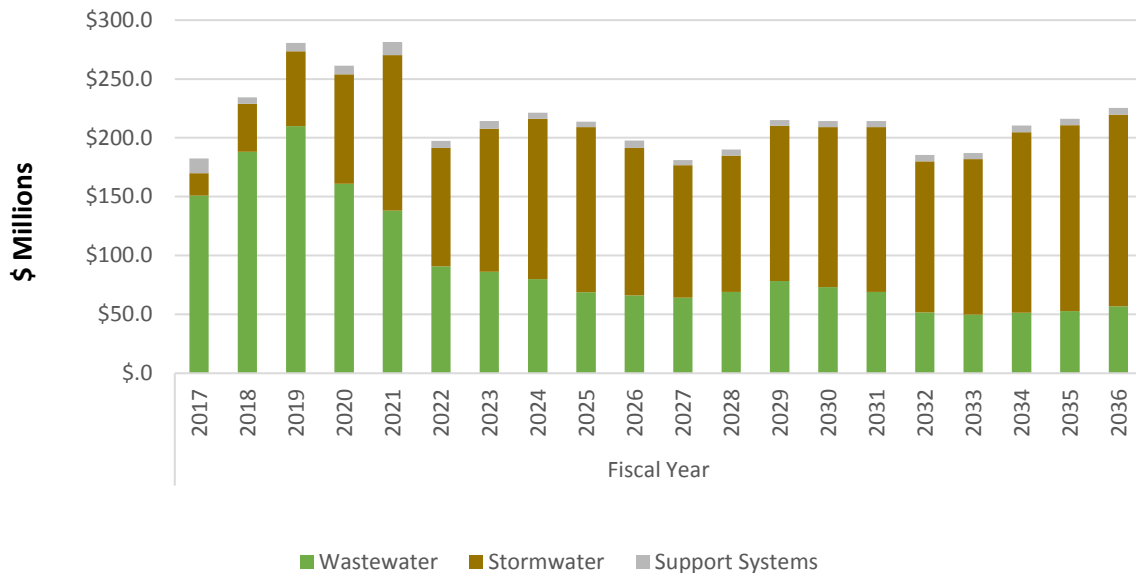
An overall schedule for the recommended CIP is included at the end of this chapter. The schedule is sorted by major service area (such as wastewater and stormwater, including Ohio River flood protection) property, and facilities. It is further sorted by project start date, which typically represents the start of construction.

## 5.3 CASH FLOW

Project cash flow was developed based on the scheduled start and finish, with the project budget spread uniformly over the years of project activity.

### 5.3.1 Capital

Overall proposed capital spending is shown on Figure 1.5-1 and listed in detail in Table 1.5-1.



**Figure 1.5-1. Recommended Overall Capital Improvement Plan**

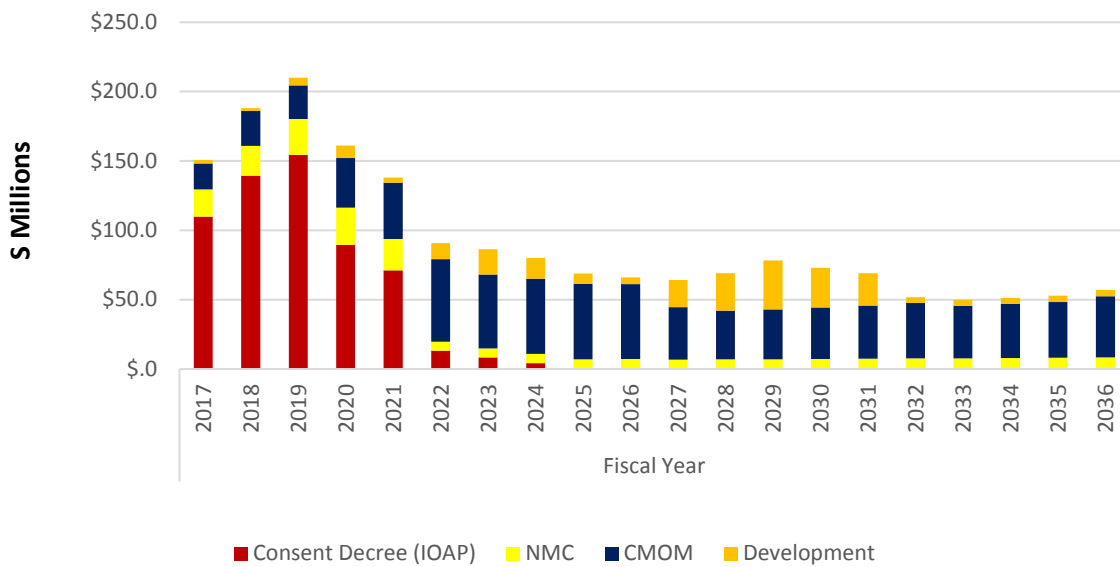


**Table 1.5-1. Facility Plan Capital Improvement Plan Recommendation Summary (in millions of dollars)**

Program	System	Fiscal Year																			
		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
ACD (IOAP)	Wastewater	\$109.9	\$139.5	\$154.4	\$89.7	\$71.1	\$13.3	\$8.5	\$4.3	\$2	\$2	\$2	\$2	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
NMC	Wastewater	\$19.7	\$21.3	\$25.9	\$26.7	\$22.6	\$6.3	\$6.4	\$6.6	\$6.8	\$7.0	\$6.6	\$6.8	\$7.0	\$7.2	\$7.4	\$7.6	\$7.7	\$8.0	\$8.2	\$8.5
CMOM	Wastewater	\$18.6	\$25.1	\$24.1	\$35.7	\$40.7	\$59.7	\$53.3	\$54.3	\$54.5	\$54.0	\$37.8	\$35.0	\$36.1	\$37.2	\$38.3	\$40.0	\$37.9	\$39.0	\$40.2	\$44.0
Development	Wastewater	\$2.6	\$2.2	\$5.6	\$9.0	\$3.6	\$11.5	\$18.1	\$14.8	\$7.5	\$5.0	\$19.5	\$27.0	\$35.2	\$28.7	\$23.3	\$4.1	\$4.2	\$4.3	\$4.4	\$4.6
<b>Total Wastewater</b>		<b>\$150.8</b>	<b>\$188.1</b>	<b>\$210.0</b>	<b>\$161.1</b>	<b>\$138.0</b>	<b>\$90.8</b>	<b>\$86.3</b>	<b>\$80.1</b>	<b>\$68.9</b>	<b>\$66.2</b>	<b>\$64.1</b>	<b>\$69.1</b>	<b>\$78.3</b>	<b>\$73.1</b>	<b>\$69.0</b>	<b>\$51.6</b>	<b>\$49.8</b>	<b>\$51.3</b>	<b>\$52.8</b>	<b>\$57.0</b>
Drainage	Stormwater	\$4.2	\$16.2	\$31.8	\$59.7	\$77.9	\$63.8	\$82.9	\$85.4	\$87.9	\$83.0	\$74.2	\$76.4	\$78.7	\$81.1	\$83.5	\$94.2	\$97.0	\$109.5	\$112.8	\$116.2
Floodplain Management	Stormwater	\$1.6	\$4.6	\$4.4	\$4.5	\$4.6	\$4.8	\$4.9	\$5.1	\$5.2	\$5.4	\$5.5	\$5.7	\$5.9	\$6.1	\$6.2	\$6.4	\$6.6	\$6.8	\$7.0	\$7.2
Ohio River Flood Protection	Stormwater	\$11.4	\$18.3	\$25.6	\$26.8	\$46.0	\$29.0	\$29.8	\$41.5	\$42.8	\$32.6	\$28.7	\$29.6	\$43.0	\$44.3	\$45.6	\$23.0	\$23.7	\$32.1	\$33.1	\$34.0
Stormwater Quality (MS4)	Stormwater	\$1.9	\$1.7	\$1.9	\$1.9	\$3.7	\$3.3	\$4.0	\$4.1	\$4.2	\$4.3	\$4.1	\$4.2	\$4.3	\$4.4	\$4.6	\$4.7	\$4.8	\$5.0	\$5.1	\$5.3
<b>Total Stormwater</b>		<b>\$19.1</b>	<b>\$40.8</b>	<b>\$63.7</b>	<b>\$93.0</b>	<b>\$132.3</b>	<b>\$100.7</b>	<b>\$121.6</b>	<b>\$136.0</b>	<b>\$140.1</b>	<b>\$125.3</b>	<b>\$112.5</b>	<b>\$115.9</b>	<b>\$131.9</b>	<b>\$135.9</b>	<b>\$140.0</b>	<b>\$128.3</b>	<b>\$132.2</b>	<b>\$153.4</b>	<b>\$158.0</b>	<b>\$162.7</b>
Capital Equipment	Support Systems	\$6	\$1.4	\$1.9	\$2.4	\$5.0	\$2.8	\$2.9	\$2.9	\$3.0	\$3.1	\$3.2	\$3.3	\$3.3	\$3.4	\$3.5	\$3.6	\$3.7	\$3.8	\$3.9	\$4.0
Facilities	Support Systems	\$10.2	\$3.1	\$4.7	\$4.2	\$5.7	\$2.0	\$2.6	\$1.1	\$7	\$1.9	\$6	\$6	\$6	\$6	\$9	\$5	\$5	\$5	\$6	\$6
IT	Support Systems	\$1.6	\$7	\$3	\$3	\$3	\$7	\$7	\$8	\$8	\$8	\$6	\$6	\$6	\$6	\$7	\$7	\$7	\$7	\$7	\$8
LOJIC	Support Systems	\$1	\$4	\$1	\$5	\$3	\$5	\$2	\$5	\$2	\$5	\$2	\$6	\$2	\$6	\$2	\$6	\$2	\$7	\$3	\$3
<b>Total Support Systems</b>		<b>\$12.5</b>	<b>\$5.5</b>	<b>\$7.0</b>	<b>\$7.4</b>	<b>\$11.2</b>	<b>\$6.0</b>	<b>\$6.4</b>	<b>\$5.3</b>	<b>\$4.7</b>	<b>\$6.3</b>	<b>\$4.5</b>	<b>\$5.0</b>	<b>\$4.8</b>	<b>\$5.3</b>	<b>\$5.3</b>	<b>\$5.4</b>	<b>\$5.2</b>	<b>\$5.7</b>	<b>\$5.5</b>	<b>\$5.6</b>
<b>Total Facility Plan</b>		<b>\$182.4</b>	<b>\$234.5</b>	<b>\$280.7</b>	<b>\$261.4</b>	<b>\$281.5</b>	<b>\$197.5</b>	<b>\$214.3</b>	<b>\$221.3</b>	<b>\$213.8</b>	<b>\$197.8</b>	<b>\$181.2</b>	<b>\$190.0</b>	<b>\$215.0</b>	<b>\$214.3</b>	<b>\$214.3</b>	<b>\$185.4</b>	<b>\$187.2</b>	<b>\$210.5</b>	<b>\$216.3</b>	<b>\$225.3</b>

### 5.3.2 Wastewater

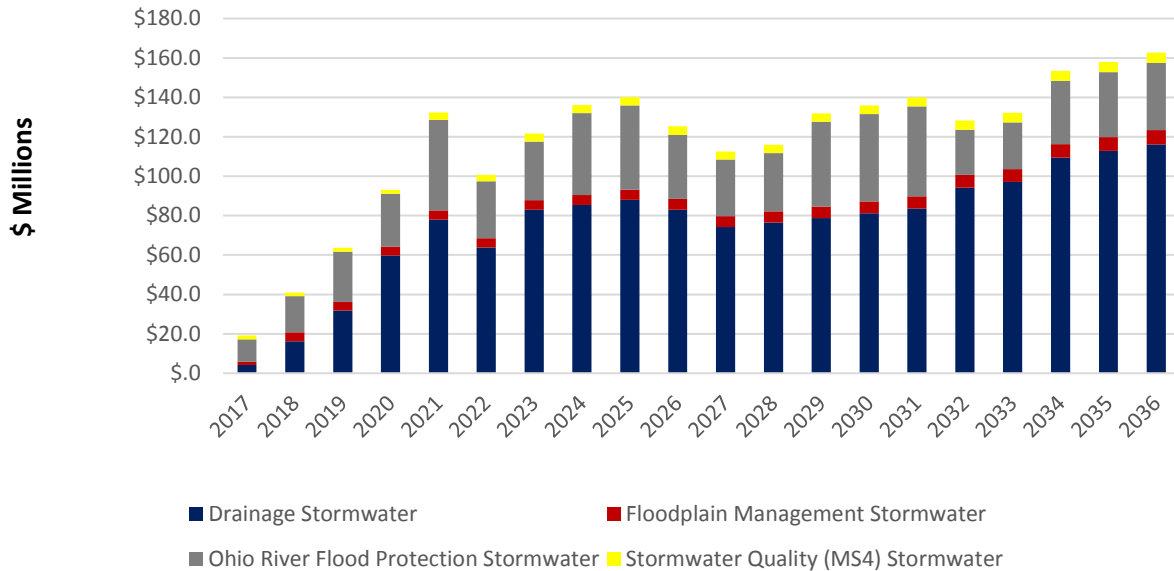
Recommended wastewater capital spending is shown on Figure 1.5-2. IOAP spending is responsible for the peaks in FY2017 through FY2019, reflecting the construction of several large CSO storage basins. IOAP spending tapers off in FY2020 and is essentially completed by the end of FY2025. In the years 2022 to 2036, relatively stable spending on the CMOM program is proposed, reflecting a recommended commitment to infrastructure renewal and replacement.



**Figure 1.5-2. Recommended Wastewater Capital Improvement Plan**

### 5.3.3 Stormwater and Ohio River Flood Protection

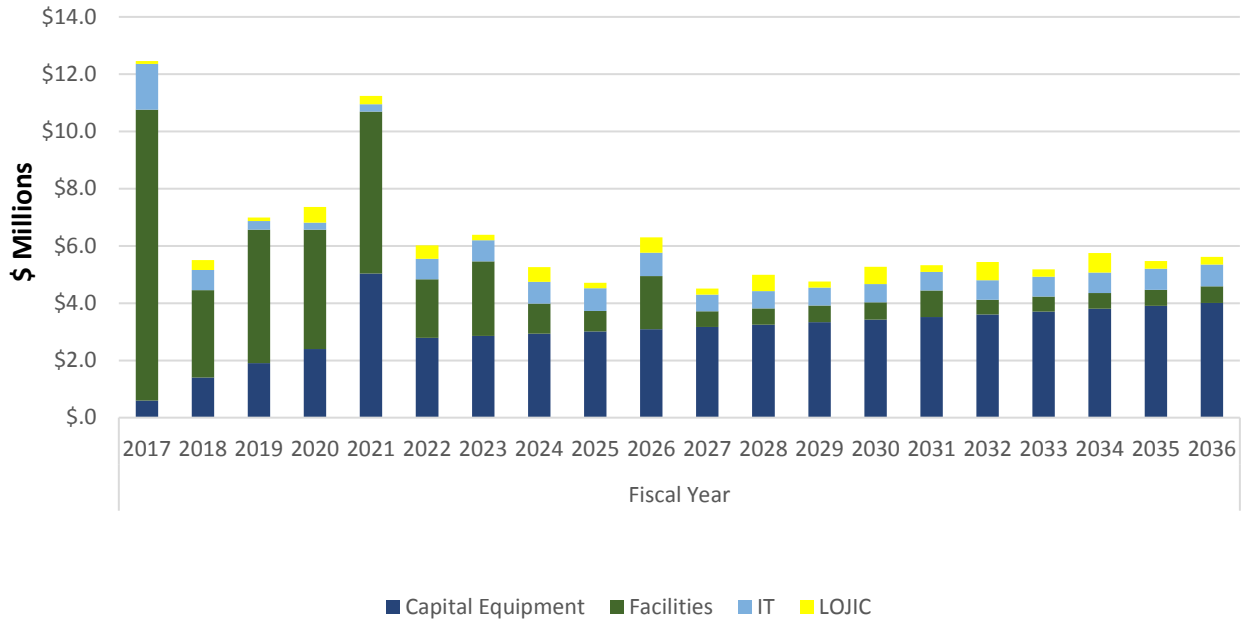
Recommended stormwater and Ohio River flood protection spending is shown on Figure 1.5-3. While stormwater and Ohio River flood protection are addressed separately in this Facility Plan, they are both funded from drainage fees, so cash flow recommendations have been consolidated. Recommended spending on stormwater and flood protection is reduced in the early years of the planning period, reflecting a CIP focus on completing the IOAP. Stormwater spending is recommended to rise as the IOAP reaches completion, reaching \$168 million in FY2036.



**Figure 1.5-3. Recommended Stormwater and Ohio River Flood Protection Capital Improvement Plan**

### 5.3.4 Property and Support Systems

Recommended property and support systems spending is shown on Figure 1.5-4. Note the scale change on the figure is used to more clearly illustrate the cash flow. Recommended cash flow is relatively high in the first few years, reflecting “catch up” on many items that need immediate attention because of the impacts of deferred maintenance over several years. After the catch-up period, the recommended cash flow reflects a stable spending level that is primarily schedule renewal and replacement of major components of MSD’s fixed assets.



**Figure 1.5-4. Recommended Property and Support Facilities Capital Improvement Plan**



## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 6 COST OF SERVICE AND RATES

#### 6.1 BACKGROUND

To evaluate the equity and fairness of utility rates, a Cost of Service study is used to identify and allocate net revenue requirements (that is, program costs adjusted for non-rate revenues) to customers based on industry guidance. The Cost of Service study presented in Sections 6.3 through 6.15 was completed in 2015 as an early deliverable for the overall Facility Plan. This Cost of Service analysis is based on the MSD organization and financial results through FY2014. After receiving the results of the Cost of Service study in early 2015, MSD chose to defer implementation of any cost allocation changes until the completion of the Facility Plan, when a better projection of future costs would be available.

MSD completed a major reorganization in FY2016 that significantly impacted the structure of its operating budget. This makes a direct application of the results of this 2015 Cost of Service study to the current financial structure difficult. MSD decided to revisit the Cost of Service analysis after the Facility Plan was completed and determine if a new analysis was warranted by the new organizational structure and the projected capital and operating budgets recommended by the Facility Plan at that time. The 2015 Cost of Service study is included in this Facility Plan to represent the approach to a Cost of Service analysis and the potential cost allocation changes that might be anticipated when this analysis is updated subsequent to Facility Plan completion.

#### 6.2 SERVICE AREA CHARACTERISTICS

Volumes 2 through 5 provide a detailed discussion of MSD's system and services area. In summary, MSD's wastewater service area includes all of Jefferson County and a small portion of Oldham County, which is operated on a contract basis. The drainage service area includes all of Jefferson County except for the cities of Shively, Jeffersontown, Prospect, and Anchorage. These cities have opted out of the Drainage Utility because they own and operate their own stormwater systems. MSD provides wastewater services to more than 240,000 customers with nearly 76 million gallons per day (MGD) of billed sewer flows. Annual average wastewater flows actually received at MSD's WQTCs is approximately 120 MGD, reflecting the impact of stormwater collection in the combined sewer system and extraneous clear water flows in the other WQTCs. MSD owns and operates five WQTCs, with a total design capacity of 170 MGD.

Based on a study prepared by the University of Louisville Urban Studies Institute (2015), the population of Jefferson County was 741,096 based on the 2010 U.S. Census and is projected to increase to approximately 817,400 by 2025, a 10 percent increase or 0.4 percent annual growth rate. The study estimated population in the Louisville Metropolitan Statistical Area (MSA) to increase 20 percent by 2035, with most of the growth occurring in counties surrounding Jefferson County.

The Urban Studies Institute’s study also looked at the growth in households and commercial/industrial (C/I) employment. The number of households in Jefferson County is projected to increase nearly 13 percent for the period 2013 to 2035, or the addition of more than 42,300 households over the next 20 years. For the period 2002 to 2011, growth in commercial activity includes the addition of roughly 18,200 jobs. For the same period, the industrial jobs decreased 17 percent.

The Urban Studies Institute’s study also looked at trends in water consumption. From 2009 to 2014, water consumption declined 2 percent per year. Declines are related to residential and commercial customers, whereas industrial water consumption increased, albeit after decades of decline. In general, water consumption in Jefferson County has declined, and the study included three water projection scenarios. The “low” scenario shows water consumption declining, whereas the “moderate” and “high” scenarios show increases overtime.

The economic crisis and recession that started in 2008 and continued for several years affected economic activity in the Louisville MSA. With high unemployment, households curbed consumption and other activities. C/I businesses responded by reducing operations. One of the outcomes is declining water consumption. Another explanation for the decline water consumption is the increased use of water conservation devices. Last, in response to increasing water and sewer rates, declines in water consumption could be partly a result of customer response to price signals (elasticity).

The purpose of the 2015 Cost of Service study is to estimate the cost of providing service to sewer and stormwater drainage customers and the development of rates and charges that are designed to recover those costs from the users in each customer class. This chapter summarizes the existing rate structure, customer flows and loadings, allocation of MSD’s revenue requirements, development of Cost of Service rates, and bill impacts. In addition, this chapter documents the analysis to support the allocation of costs between sewer and drainage services, cost allocations associated with fixed and variable costs, and development of Cost of Service rates for customer classes and rate components.

### **6.3 EXISTING RATE STRUCTURE**

MSD’s existing rate structure includes a mix of charges based on the number of accounts, meter size, metered water consumption, waste strength, and impervious area. An adjustment is applied for “regular” water use not entering the sewer system and is based on customer type (such as, residential, commercial, and industrial). The rate structure addresses affordability for customers age 65 and older with incomes below a specified income level. Customers can receive a credit against their stormwater charge if they have onsite stormwater retention or detention facilities. The existing rate structure consists of the following rate components:

- Service charges (costs per bill)
- Volume charges (costs per 1,000 gallons)
- Quality charges (costs per pound)
- Consent Decree charges (costs per bill or costs per 1,000 gallons)
- Drainage-stormwater charges (costs per equivalent service units [ESUs])



### 6.3.1 Service Charges

The service charges are intended to recover the customer and billing costs, and varies based on meter size, customer type (residential, C/I), and billing frequency (monthly versus bimonthly). Meter size is used to set the service charge to recognize the cost of different flow capacities relative to typical residential meter (that is, 5/8-inch). For example, the flow characteristics for a 10-inch meter are larger than a 5/8-inch meter. Differences between types of customers recognize the Cost of Service is based on customer characteristics. Similarly, the difference between billing frequency is based on the Cost of Service for billing costs, which includes items such as postage, accounting, and collections. Table 1.6-1 lists the service charges effective August 1, 2014, and provides the equivalent meter (EQM) relative to the typical residential meter size (5/8-inch or 3/4-inch). The EQM for monthly charges differ between residential and C/I categories by more than 50 percent. The EQM for bimonthly charges is similar for residential and C/I categories.

**Table 1.6-1. Wastewater Service Charges (costs per bill) Effective August 1, 2014**

Meter Size (inches)	Monthly Charge per Bill	EQM Ratio <sup>a</sup>	Bimonthly Charge per Bill	EQM Ratio <sup>a</sup>
<b>Residential</b>				
5/8 or 3/4	\$12.22	1.00	\$24.44	1.00
1	\$24.54	2.01	\$49.08	2.01
1-1/2	\$40.83	3.34	\$81.16	3.32
2	\$55.99	4.58	\$111.99	4.58
3	\$124.83	10.22	\$249.66	10.22
4	\$201.83	16.52	\$403.66	16.52
<b>Commercial/Industrial</b>				
5/8 or 3/4	\$18.76	1.54	\$24.44	1.00
1	\$32.71	2.68	\$49.08	2.01
1-1/2	\$49.08	4.02	\$81.06	3.32
2	\$63.02	5.16	\$111.99	4.58
3	\$133.30	10.91	\$249.66	10.22
4	\$210.04	17.19	\$403.66	16.52
6	\$403.58	33.03	\$793.18	32.45
8	\$606.58	49.64	\$1,189.79	48.68
10	\$793.18	64.91	\$1,563.10	63.96
12	\$1,151.56	94.24	\$2,303.13	94.24
15 or 16	\$1,395.85	114.23	\$2,791.62	114.22
18 or 20	\$1,832.02	149.92	\$3,664.04	149.92

<sup>a</sup> Equivalent meter ratio, relative to residential 5/8- or 3/4-inch meter.

For private meters (PMs), such as, effluent flow, addition, and subtract meters, MSD charges for each meter that is read. These meter readings are mostly for C/I customers; however, there are a couple of residential PMs. Readings are either monthly or bimonthly and customers are charged the same rate per meter read. The revenue generated from PM reading charges recovers the costs associated with the manual read of each PM.

### **6.3.2 Volume Charges**

MSD assesses a volume charge to customers based on billed water consumption. Volume charges help recover the Cost of Service related to collection and treatment wastewater flows. MSD uses water consumption data and applies adjustments to reflect water usage that does not directly enter the sewer system, such as lawn watering. These discounts apply to “regular” volume rates and are 15 percent for residential customers, 10 percent for commercial, and 5 percent for industrial. For example, if a residential customer has 1,000 gallons of billed water consumption, the amount of water entering the sewer system is assumed to be 85 percent of billed water consumption or 850 gallons. Volume charges include the following:

- Regular volume rate applies to customers that do not meet optional volume rate requirements and assumes domestic strength flows.
- Optional (clean) volume rate applies to customers that have opted to have their volume rates based on flow costs and rates for biochemical oxygen demand (BOD) and total suspended solids (TSS), based on monitored loadings through periodic sampling. To be eligible for this option, the customer’s average water use during a consecutive 12-month period must exceed 1,000,000 gallons per month.
- Sewer-only volume rate applies to customers that have wastewater flows directly measured by PM or addition/subtraction meters.

### **6.3.3 Water Quality Surcharges**

Quality charges help recover the costs of treating high-strength discharges and are mostly attributed to commercial, institutional, and industrial customers. Quality charges are assessed based on estimate loadings (pounds) of BOD and TSS. High-strength discharges are wastewater flows that exceed 250 milligrams per liter (mg/L) for BOD and 270 mg/L for TSS. To determine the strength (concentration) of wastewater discharges for billing purposes, periodic sampling is conducted. Customers who pay the “regular volume rates” are categorized as excess quality charges, whereas customers who pay the “optional volume rates” are categorized as total quality charges.

### **6.3.4 Consent Decree Charges**

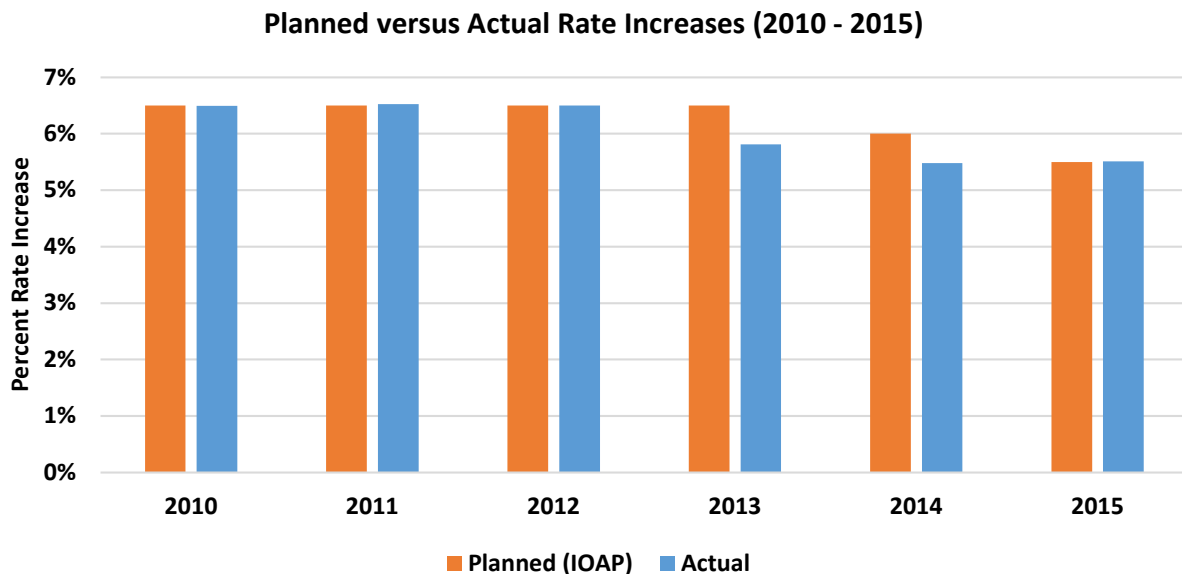
The EPA Consent Decree charges help recover the costs associated with Consent Decree compliance requirements. The charges are applied to all customers. For residential customers, the charge is applied to each bill. For nonresidential customers, the charge is applied to each bill based on the larger of a flat rate per bill or volume rate per 1,000 gallons of billed water consumption.

### 6.3.5 Stormwater Charges

Stormwater charges help recover the O&M and capital costs associated with the drainage-stormwater system. Stormwater charges are assessed based on ESUs, which are a measure of impervious area relative to a single-family residential property. An ESU was determined to be 2,500 square feet of impervious area. Properties are designated as either Class A (single-family residential, one or two dwelling units) or Class B (all other properties that are not single-family residential, one or two dwelling units). Properties designated as Class A are assessed a charge based on 1 ESU; whereas Class B properties are assessed a charge relative to 1 ESU. For example, a Class B property with 25,000 square feet of impervious area is assessed a charge that is 10 times drainage-stormwater 1 ESU (25,000/2,500). If a Class B property owns and maintains onsite stormwater retention or detention facilities, then the property owner can apply for a credit against the charge.

### 6.4 HISTORICAL RATE INCREASES AND SERVICE CHARGE REVENUES

This section provides historical context for rate increases and service charge revenues. For the years 2010 to 2012, the average rate increase was 6.5 percent. In 2013, the average rate increase was 5.8 percent compared with the IOAP planned increase of 6.5 percent. In 2014, the average rate increase was 3.9 percent, which was influenced by a decrease in the residential monthly wastewater service charge. Excluding the residential monthly wastewater service charge, the rate increase in 2014 was 5.5 percent compared with the IOAP projected increase of 6 percent. Figure 1.6-1 provides a summary of planned versus actual rate increases for the period 2010 to 2015. In 2013 and 2014, rate increases were lower than planned because of a “favorable financial result” and portions of savings were passed onto customers.



**Figure 1.6-1. Summary of Planned Versus Actual Rate Increase for the Period 2010 to 2015**



Table 1.6-2 summarizes the monthly wastewater service charges from 2009 to 2015. Table 1.6-3 summarizes the bimonthly wastewater service charges for the same period. In 2014, the wastewater service charges decreased for monthly residential customers, except for residential customers with 4-inch connections. From 2009 to 2013, the residential bimonthly charge was 130 percent of the monthly charge, which reflects the Cost of Service for different billing frequencies. In 2009, the cost of residential monthly billing was 154 percent of bimonthly billing. Based on adjustments to the residential monthly bill in 2014, the costs of residential monthly and bimonthly billing are the same. From 2009 to 2013, the monthly service charges were the same for residential, C/I customers. Starting in 2014, the monthly service charges for C/I customers were higher than residential customers by as much as 54 percent. One concern is that the 2014 adjustments do not represent the Cost of Service relationships and results in inter-class subsidies (that is, monthly bills for C/I customers are greater than residential customers). Table 1.6-4 presents the historical volume charge rates, which have increased 5.5 percent to 6.5 percent each year since 2010.

**Table 1.6-2. Historical Monthly Wastewater Service Charges (costs per bill)**

Meter Size (inches)	2009	2010	2011	2012	2013	2014	2015
<b>Residential</b>							
Percent Increase <sup>a</sup>		6.50%	6.50%	6.50%	5.80%	-11.74%	5.50%
5/8 or 3/4	\$13.92	\$14.82	\$15.78	\$16.81	\$17.78	\$12.22	\$12.89
1	\$24.25	\$25.83	\$27.51	\$29.30	\$31.00	\$24.54	\$25.89
1-1/2	\$36.40	\$38.77	\$41.29	\$43.97	\$46.52	\$40.83	\$43.08
2	\$46.74	\$49.78	\$53.02	\$56.46	\$59.73	\$55.99	\$59.07
3	\$98.86	\$105.29	\$112.13	\$119.42	\$126.35	\$124.83	\$131.70
4	\$155.75	\$165.87	\$176.65	\$188.18	\$199.09	\$201.83	\$212.93
<b>Commercial/Industrial</b>							
Percent Increase <sup>a</sup>		6.50%	6.50%	6.50%	5.80%	5.50%	5.50%
5/8 or 3/4	\$13.92	\$14.82	\$15.78	\$16.81	\$17.78	\$18.76	\$19.79
1	\$24.25	\$25.83	\$27.51	\$29.30	\$31.00	\$32.71	\$34.51
1-1/2	\$36.40	\$38.77	\$41.29	\$43.97	\$46.52	\$49.08	\$51.78
2	\$46.74	\$49.78	\$53.02	\$56.46	\$59.73	\$63.02	\$66.49
3	\$98.86	\$105.29	\$112.13	\$119.42	\$126.35	\$133.30	\$140.63
4	\$155.75	\$165.87	\$176.65	\$188.18	\$199.09	\$210.04	\$221.59
6	\$299.32	\$318.78	\$339.50	\$361.57	\$382.54	\$403.58	\$425.78
8	\$449.89	\$479.13	\$510.27	\$543.44	\$574.96	\$606.58	\$639.94
10	\$588.28	\$626.52	\$667.24	\$710.61	\$751.83	\$793.18	\$836.80
12	\$854.08	\$909.60	\$968.72	\$1,031.69	\$1,091.53	\$1,151.56	\$1,214.90
15 or 16	\$1,035.27	\$1,102.56	\$1,174.23	\$1,250.55	\$1,323.08	\$1,395.85	\$1,472.62
18 or 20	\$1,358.76	\$1,447.08	\$1,541.14	\$1,641.31	\$1,736.51	\$1,832.02	\$1,932.78



**Table 1.6-2. Historical Monthly Wastewater Service Charges (costs per bill)**

Meter Size (inches)	2009	2010	2011	2012	2013	2014	2015
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<sup>a</sup> Percent increases are averages for the customer class (such as, residential).  
 Source: MSD (2016).

**Table 1.6-3. Historical Bimonthly Wastewater Service Charges (costs per bill)**

Meter Size (inches)	2009	2010	2011	2012	2013	2014	2015
<b>Residential</b>							
Percent Increase <sup>a</sup>		6.50%	6.50%	6.50%	5.80%	5.39%	5.61%
5/8 or 3/4	\$18.13	\$19.31	\$20.57	\$21.90	\$23.17	\$24.44	\$25.78
1	\$36.40	\$38.77	\$41.29	\$43.97	\$46.52	\$49.08	\$51.78
1-1/2	\$60.56	\$64.50	\$68.69	\$73.16	\$77.40	\$81.16	\$86.15
2	\$83.06	\$88.46	\$94.21	\$100.33	\$106.15	\$111.99	\$118.15
3	\$185.16	\$197.20	\$210.02	\$223.67	\$236.64	\$249.66	\$263.39
4	\$299.38	\$318.84	\$339.56	\$361.64	\$382.62	\$403.66	\$425.86
<b>Commercial/Industrial</b>							
Percent Increase <sup>a</sup>		6.50%	6.50%	6.50%	5.80%	5.45%	5.55%
5/8 or 3/4	\$18.13	\$19.31	\$20.57	\$21.90	\$23.17	\$24.44	\$25.78
1	\$36.40	\$38.77	\$41.29	\$43.97	\$46.52	\$49.08	\$51.78
1-1/2	\$60.56	\$64.50	\$68.69	\$73.16	\$77.40	\$81.16	\$86.15
2	\$83.06	\$88.46	\$94.21	\$100.33	\$106.15	\$111.99	\$118.15
3	\$185.16	\$197.20	\$210.02	\$223.67	\$236.64	\$249.66	\$263.39
4	\$299.38	\$318.84	\$339.56	\$361.64	\$382.62	\$403.66	\$425.86
6	\$588.28	\$626.52	\$667.24	\$710.61	\$751.83	\$793.18	\$836.80
8	\$882.44	\$939.80	\$1,000.89	\$1,065.94	\$1,127.76	\$1,189.79	\$1,255.23
10	\$1,159.31	\$1,234.67	\$1,314.92	\$1,400.39	\$1,481.61	\$1,563.10	\$1,649.07
12	\$1,708.17	\$1,819.20	\$1,937.45	\$2,063.38	\$2,183.06	\$2,303.13	\$2,429.80
15 or 16	\$2,070.48	\$2,205.06	\$2,348.39	\$2,501.03	\$2,646.09	\$2,791.62	\$2,945.16
18 or 20	\$2,717.52	\$2,894.16	\$3,082.28	\$3,282.63	\$3,473.02	\$3,664.04	\$3,865.56

<sup>a</sup> Percent increases are averages for the customer class (such as, residential).  
 Source: MSD, (2016).



**Table 1.6-4. Historical Volume Charges (costs per 1,000 gallons)**

Customer Class	2009	2010	2011	2012	2013	2014	2015
<b>Regular Volume Rate</b>							
Percent Increase		6.48%	6.53%	6.45%	5.76%	5.44%	5.43%
Residential	\$2.49	\$2.65	\$2.82	\$3.00	\$3.17	\$3.34	\$3.52
Commercial	\$2.86	\$3.05	\$3.25	\$3.46	\$3.66	\$3.86	\$4.07
Industrial	\$2.98	\$3.17	\$3.38	\$3.60	\$3.81	\$4.02	\$4.24
<b>Optional Volume Rate</b>							
Percent Increase		6.51%	6.67%	6.25%	5.88%	5.56%	5.70%
Commercial, Industrial	\$1.69	\$1.80	\$1.92	\$2.04	\$2.16	\$2.28	\$2.41
<b>Sewer-Only Volume Rate</b>							
Percent Increase		6.61%	6.59%	6.46%	5.86%	5.53%	5.43%
Residential	\$2.85	\$3.04	\$3.24	\$3.45	\$3.65	\$3.85	\$4.06
Commercial-Regular	\$3.20	\$3.41	\$3.63	\$3.87	\$4.09	\$4.31	\$4.55
Commercial-Optional	\$1.81	\$1.93	\$2.06	\$2.19	\$2.32	\$2.45	\$2.58
Industrial-Regular	\$3.21	\$3.42	\$3.64	\$3.88	\$4.11	\$4.34	\$4.58
Industrial-Optional	\$1.81	\$1.93	\$2.06	\$2.19	\$2.32	\$2.45	\$2.58

Table 1.6-5 presents the historical EPA Consent Decree surcharge rates, which have increased 5.5 percent to 6.5 percent each year since 2010. The EPA Consent Decree surcharge was implemented in 2009 to fund capital and O&M costs associated with the Consent Decree.

**Table 1.6-5. Historical U.S. Environmental Protection Agency Consent Decree Surcharges**

Customer Class	2009	2010	2011	2012	2013	2014	2015
<b>Regular Volume Rate</b>							
Percent Increase		6.54%	6.39%	6.64%	5.72%	5.40%	5.60%
Residential-Monthly	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
Residential-Bimonthly	\$14.80	\$15.76	\$16.78	\$17.87	\$18.92	\$19.96	\$21.06
Commercial (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.88	\$0.94	\$1.00	\$1.07	\$1.13	\$1.19	\$1.26
Industrial (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.93	\$0.99	\$1.05	\$1.12	\$1.18	\$1.24	\$1.31



**Table 1.6-5. Historical U.S. Environmental Protection Agency Consent Decree Surcharges**

Customer Class	2009	2010	2011	2012	2013	2014	2015
<b>Optional Volume Rate</b>							
Percent Increase		6.47%	6.72%	6.54%	5.97%	5.63%	5.48%
Clean Volume (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.52	\$0.55	\$0.59	\$0.63	\$0.67	\$0.71	\$0.75
Sewer Only Volume (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.56	\$0.60	\$0.64	\$0.68	\$0.72	\$0.76	\$0.80
<b>Sewer-Only Volume Rate</b>							
Percent Increase		6.28%	6.57%	6.41%	5.85%	5.53%	5.39%
Commercial (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.99	\$1.05	\$1.12	\$1.19	\$1.26	\$1.33	\$1.40
Industrial (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$0.99	\$1.05	\$1.12	\$1.19	\$1.26	\$1.33	\$1.40
<b>Without Water Meter for Each Condominium Unit</b>							
% Increase		6.50%	6.67%	6.50%	5.93%	5.60%	5.45%
Condominium (greater of...)							
\$/bill	\$7.40	\$7.88	\$8.39	\$8.94	\$9.46	\$9.98	\$10.53
\$/1,000 gallons	\$1.23	\$1.31	\$1.40	\$1.49	\$1.58	\$1.67	\$1.76

Table 1.6-6 presents the historical water quality charge rates, which have increased 5.5 percent to 6.5 percent each year since 2010. The water quality charge for BOD and TSS recover the costs associated with excess strength surcharges. Table 1.6-7 presents the historical drainage-stormwater charge rates, which have increased 5.5 percent to 6.5 percent each year since 2010.

**Table 1.6-6. Historical Water Quality Charges (costs per pound)**

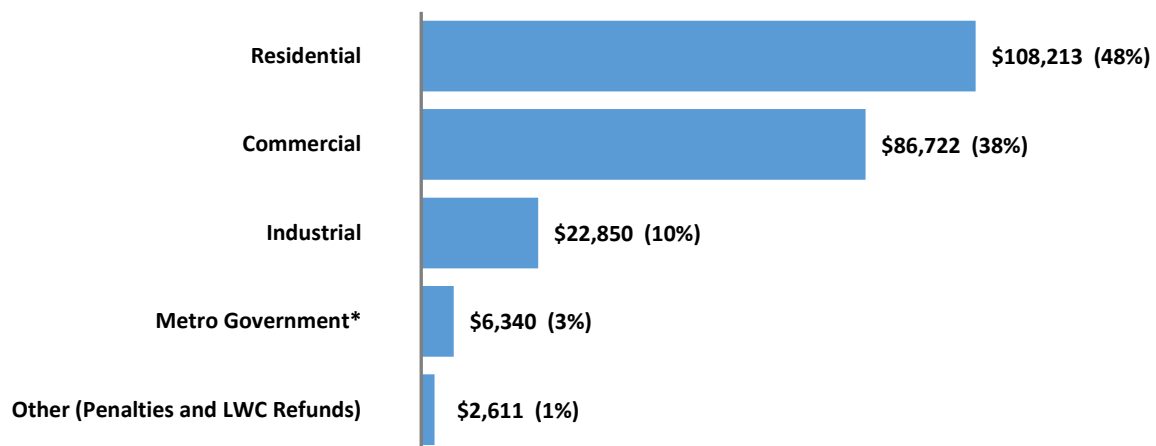
Pollutant	2009	2010	2011	2012	2013	2014	2015
<b>Wastewater Characterized as Excess Strength</b>							
Percent Increase		6.51%	6.52%	6.51%	5.81%	5.52%	5.49%
BOD (greater than 250 mg/L)	\$0.2829	\$0.3013	\$0.3209	\$0.3418	\$0.3616	\$0.3816	\$0.4026
TSS (greater than 270 mg/L)	\$0.1166	\$0.1242	\$0.1323	\$0.1409	\$0.1491	\$0.1573	\$0.1659

**Table 1.6-7. Historical Drainage-Stormwater Charges (\$/ESU)**

Property Class	2009	2010	2011	2012	2013	2014	2015
<b>Drainage-Stormwater</b>							
Percent Increase		6.49%	6.43%	6.50%	5.81%	5.49%	5.47%
Class A (\$/ESU)	\$5.70	\$6.07	\$6.46	\$6.88	\$7.28	\$7.68	\$8.10
Class B (\$/ESU)	\$5.70	\$6.07	\$6.46	\$6.88	\$7.28	\$7.68	\$8.10

During FY2014, approximately \$214 million in service charge revenues were collected from the rate structure summarized in Section 6.2. Figure 1.6-2 summarizes the distribution of FY2014 service charge revenues by account type, and Figure 1.6-3 summarizes the distribution by rate component. Table 1.6-8 summarizes service charge revenues according to customer type by rate component for FY2009 to FY2014. For the same period, total service charge revenues increased 5.6 percent (based on compounded annual growth rate), compared with the average rate increase of 6.1 percent for all rate components. The residential customer group represents 51 percent of the service charge revenues (gross of reductions associated with Metro Government). Sewer and stormwater services are initially charged to Metro Government and then refunded as “payment in lieu of taxes.” This represents approximately 3 percent of revenues. When looking at revenues by rate component, volume charges represents the largest portion, which elevates the concern about revenue stability, especially given the continued decline of water consumption.

**Service Charge Revenues by Customer Type – FY2014 (thousands of dollars)**



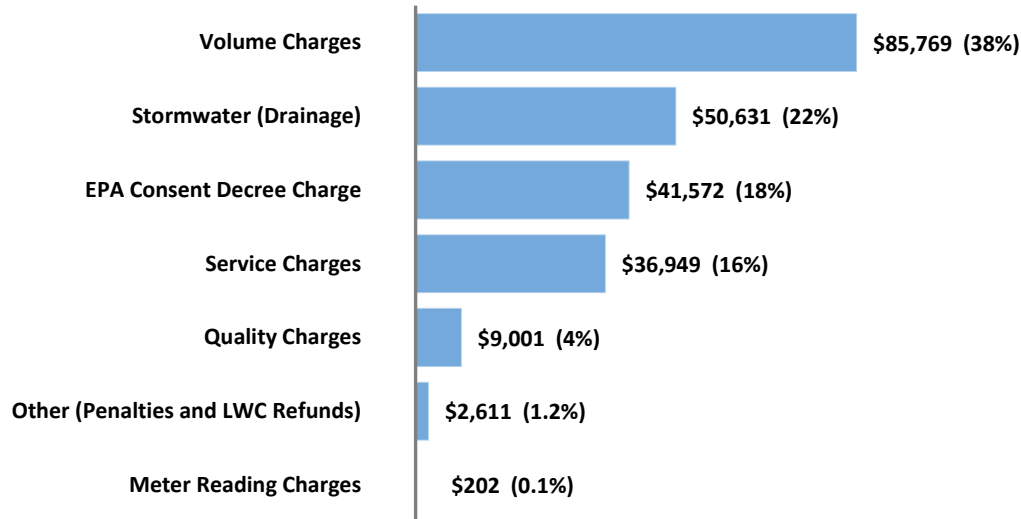
\*Revenue from Metro Government is offset by refund to reflect free service. Amount is shown here to illustrate Cost of Service to Metro Government.

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**Figure 1.6-2. FY2014 Revenues by Customer Type (thousands of dollars)**



Service Charge Revenues by Rate Component – FY2014 (thousands of dollars)



*Figure 1.6-3. FY2014 Revenues by Rate Component (thousands of dollars)*

**Table 1.6-8. Historical Revenues from Rates and Charges (Thousands of Dollars)**

Service Charge Revenues	2009	2010	2011	2012	2013	2014
<b>Residential</b>						
Service Charges				\$26,077	\$28,052	\$29,628
Volume Charges				\$33,198	\$35,281	\$35,513
Meter Reading Charges				\$1	\$1	\$1
EPA Consent Decree Charge				\$21,504	\$23,075	\$24,549
Stormwater				\$15,907	\$17,372	\$18,522
<b>Total Residential</b>				\$96,686	\$103,781	\$108,213
<b>Commercial</b>						
Service Charges				\$5,945	\$6,363	\$6,744
Volume Charges				\$34,831	\$37,881	\$38,605
Quality Charges				\$855	\$897	\$652
Meter Reading Charges				\$108	\$118	\$131
EPA Consent Decree Charge				\$11,378	\$11,933	\$12,679
Stormwater				\$23,017	\$26,123	\$27,910



**Table 1.6-8. Historical Revenues from Rates and Charges (Thousands of Dollars)**

Service Charge Revenues	2009	2010	2011	2012	2013	2014
<b>Total Commercial</b>				\$76,133	\$83,315	\$86,722
<b>Industrial</b>						
Service Charges				\$440	\$508	\$524
Volume Charges				\$6,571	\$7,828	\$8,237
Quality Charges				\$8,738	\$8,696	\$8,350
Meter Reading Charges				\$63	\$67	\$70
EPA Consent Decree Charge				\$2,249	\$2,436	\$2,557
Stormwater				\$2,575	\$2,956	\$3,112
<b>Total Industrial</b>				\$20,638	\$22,492	\$22,850
<b>Other (Penalties and LWC Refunds)</b>						
Metro Government <sup>a</sup>				\$2,219	\$2,267	\$2,611
Wastewater Charges				\$4,551	\$5,613	\$5,253
Stormwater Charges				\$643	\$1,020	\$1,087
<b>Total Metro Government</b>				\$5,194	\$6,633	\$6,340
<b>Total service charges</b>	\$163,004	\$168,610	\$183,297	\$200,870	\$218,488	\$226,736

Source: MSD (2015).

<sup>a</sup> Metro Government costs for wastewater and stormwater services.

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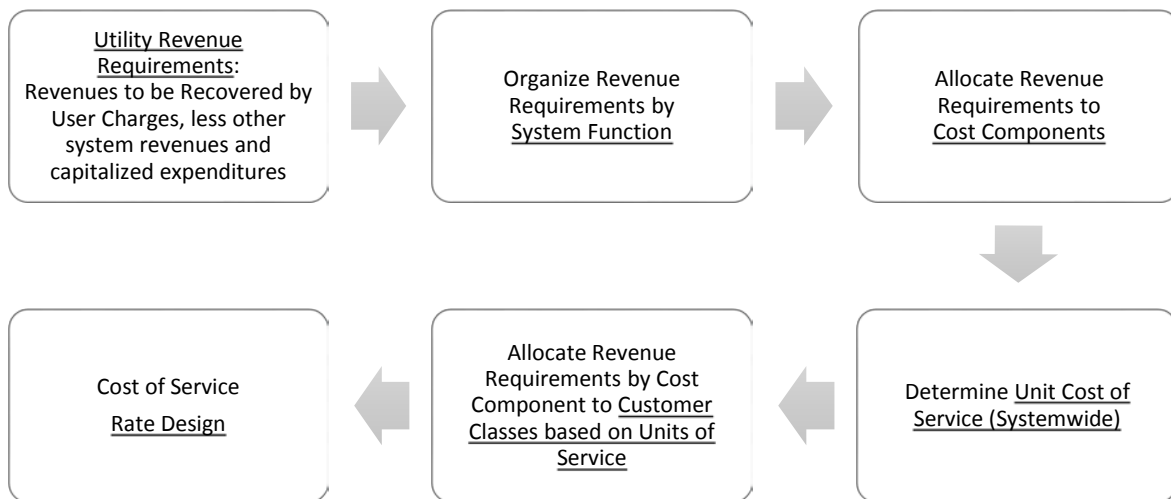
## 6.5 COST OF SERVICE METHODOLOGY

The Cost of Service methodology is grounded in knowledge of MSD’s wastewater system, the Facility Plan Team’s experience conducting these types of studies nationwide, and involvement in the development of industry guidance, such as the Water Environment Federation’s *Manual of Practice 27 Financing and Charges for Wastewater System* (2004).

The drivers or impetus for conducting a Cost of Service study includes equity and fairness of the rates among and between rate classes based on service requirements. The previous Cost of Service study was completed in 2009 to help identify changes to the existing rate structure. A study will evaluate financial, system usage, and customer information. Conducting a Cost of Service study helps to facilitate the design and implementation of a fair and equitable rate structure. Through a Cost of Service study, evaluating customer characteristics could help identify inter- and intra-class subsidies. In addition, a Cost of Service study could help determine if the revenues from rate components correctly match the costs. The Cost of Service study identifies the costs of providing wastewater service and allocation of costs to system classifications (that is, flow, BOD, and TSS) and then to customer classes (that is, residential and commercial). There are several drivers for conducting a Cost of Service, including the following:

- Change in customer characteristics (that is, proportions of residential to commercial and industrial)
- Change in water consumption and billed sewer flows
- Change in cost structure (that is, O&M compared to capital)
- Inter- or intra-class subsidies
- Evaluation of a new or changes to a rate structure (that is, service charge and volume charge)
- Revenue stability

The data flow framework for Cost of Service allocations and rate design is presented on Figure 1.6-4. The Utility Revenue Requirements reflects O&M, debt service costs, and adjustments for capitalized expenditures and other non-rate revenues. The data flow illustrates the progressive steps of organizing revenue requirement by system functions and cost components. The units of service are based on the evaluation of system and customer characteristics. The last step in framework is the development of a Cost of Service rate design, which is then used to facilitate rate structure adjustments to meet the goals and objectives of MSD.



**Figure 1.6-4. Data Flow Framework for Cost of Service Allocations and Rate Design**

To help in the allocation process, it is useful to organize costs by system functions. As part of the 2015 Cost of Service study, O&M data from MSD are organized into the following departments, which represent MSD’s organization structure at the end of FY2014:

- |                                 |                     |
|---------------------------------|---------------------|
| • Collections System            | • Executive Offices |
| • Drainage and Flood Protection | • Finance           |
| • Engineering                   | • Human Resources   |



- Information Technology
- Overhead
- Performance Matrix
- Legal Services
- Support Services
- Treatment Facilities

In addition, O&M costs are further organized into cost centers, which are representative of the following functional categories that were in place during FY2014:

- Administration
- Air Float
- Biosolids
- Catch Basin Cleaning
- Centrifuge
- Chemical
- Chlorination and Dechlorination
- Collection System
- Dewatering
- Drainage and Flood
- Dryers
- Engineering
- Final Effluent
- General Maintenance
- Laboratory
- Mesophilic
- Offloading
- Operation Overhead
- Primary Treatment
- Pump Station
- Secondary Aeration
- Secondary Clarifier
- Secondary Treatment
- Tertiary
- Utility
- Ultraviolet Disinfection

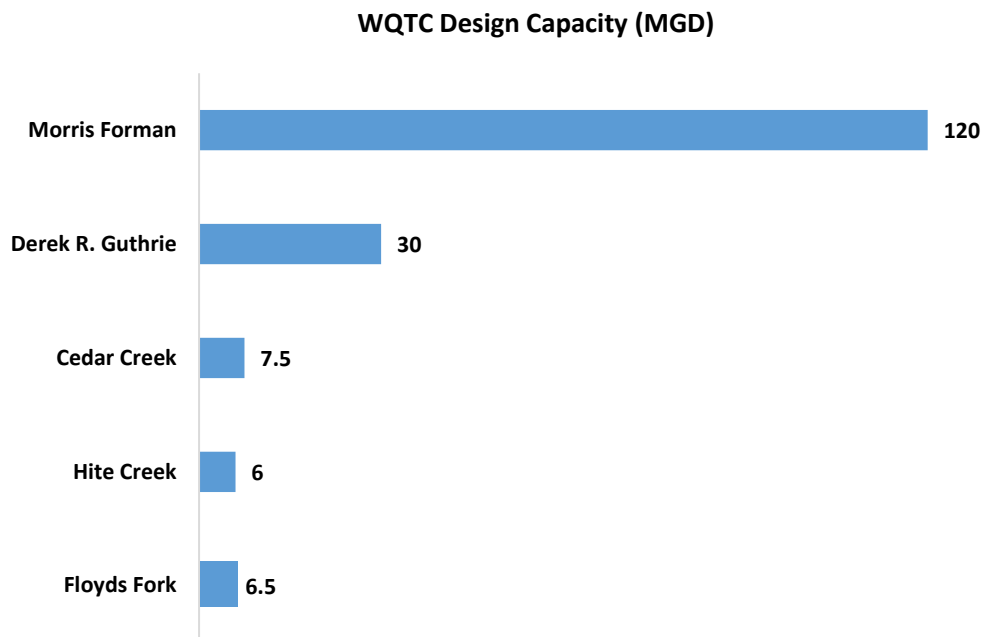
Once costs and revenue requirements are allocated to system functions, items can be classified into cost components (such as, flow and BOD). The cost components represent the cost causation factor. For example, cost associated with primary clarifiers at treatment facilities are attributed to customer flows. Hence, costs for primary clarifiers are allocated to the flow cost component; whereas finance department costs related to wastewater billing and collection are allocated to the billing cost component. Items difficult to assign to a particular cost component are allocated to the indirect cost component. Once the cost allocation process is complete, indirect costs are reallocated to other cost components based on an appropriate allocation factor (that is, based on allocated O&M and rate base). The cost components (classifications) used for purposes of the Cost of Service study include:

- Flow
- BOD
- TSS
- Industrial Waste Department (IWD)
- Customer Service
- Billing
- EPA Consent Decree
- Drainage-Stormwater
- Flood Protection
- Indirect

The test year is the period on which the Cost of Service study is based. The test year is typically based on a period, which represent normal conditions. In some cases, the test year could be based on either historical or projected periods. When selecting a test year, there are several considerations, including data availability, timing of rate adjustments, and regulatory requirements. Based on input from MSD, for purposes of this study, the test year is FY2014 (July 1, 2013 to June 30, 2014). Therefore, the components of the revenue requirements, customer data, and system flows and loadings are based on results from FY2014. MSD’s reorganization completed in FY2016 changed some of the departments and cost centers. If an updated Cost of Service analysis is completed following the completion of the Facility Plan, then it should follow the most current organization of departments and cost centers.

## 6.6 SYSTEM CHARACTERISTICS

The system characteristics consider the wastewater flows received at five WQTCs. MSD owns and operates the following five WQTCs: Cedar Creek, Derek R. Guthrie (formerly West County), Floyds Fork, Hite Creek, and Morris Forman. The total capacity for each WQTC is approximately 170 MGD. The Morris Forman WQTC represents the largest portion of the capacity. In 2015, the Jeffersontown and several other small developer-built systems representing about 6.6 MGD were decommissioned and are not included in the analysis. The design capacities for each of the WQTCs are summarized in Figure 1.6-5.



**Figure 1.6-5. Summary of Design Water Quality Treatment Center Capacities**

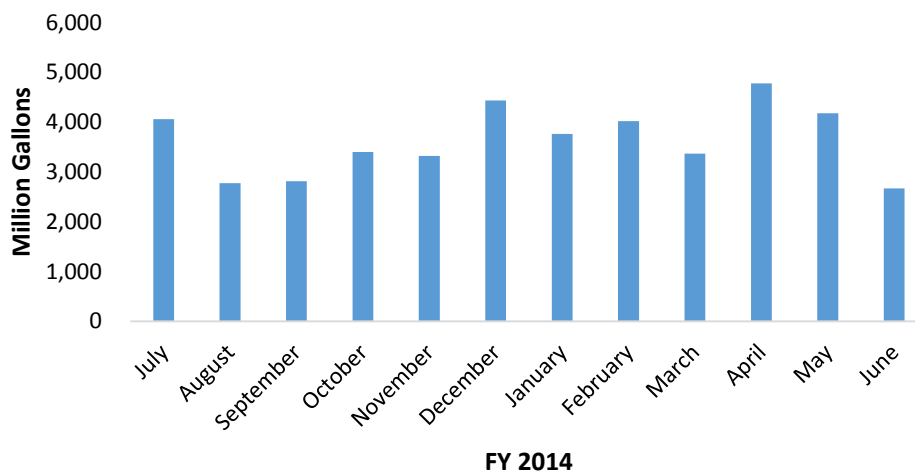
Data from the monthly WQTC Monthly Operating Reports (MORs) were compiled for the test year and are summarized in Table 1.6-9. The total flows received at the five WQTCs during FY2014 are summarized on Figure 1.6-6. The average day flow is 119.5 MGD with a maximum day flow of 263.1 MGD, which occurred on October 6, 2013. The average day to maximum day ratio for FY2014 is

0.45. BOD and TSS loadings for wastewater flows received at the plant are estimated based on monthly WQTC MOR data, which included the average concentrations for raw influent. Table 1.6-10 summarizes the monthly average TSS concentrations (mg/L) received at the WQTCs in FY2014. Table 1.6-11 summarizes monthly TSS loadings by WQTC for raw influent received. Figure 1.6-7 summarizes monthly TSS loading for all WQTCs, excluding the developer-built systems.

**Table 1.6-9. Monthly Flows (million gallons) Received at Water Quality Treatment Centers in FY2014**

Year	Month	Cedar Creek	Derek R. Guthrie	Floyds Fork	Hite Creek	Morris Forman	Total Flows
2013	July	98	130	71	130	3,634	4,063
2013	August	68	102	55	102	2,454	2,780
2013	September	88	109	63	109	2,447	2,814
2013	October	113	133	79	133	2,943	3,401
2013	November	120	127	80	127	2,872	3,326
2013	December	148	152	100	152	3,886	4,438
2014	January	129	139	83	139	3,279	3,769
2014	February	138	147	86	147	3,508	4,025
2014	March	116	133	75	133	2,914	3,370
2014	April	150	177	107	177	4,170	4,781
2014	May	131	159	103	159	3,631	4,184
2014	June	77	114	72	114	2,293	2,671
<b>Total FY2014</b>		<b>1,376</b>	<b>1,621</b>	<b>974</b>	<b>1,621</b>	<b>38,030</b>	<b>43,622</b>

**Total Flows Received at MSD's WWTPs**



**Figure 1.6-6. Total Flows Received at MSD's Water Quality Treatment Centers during FY2014**



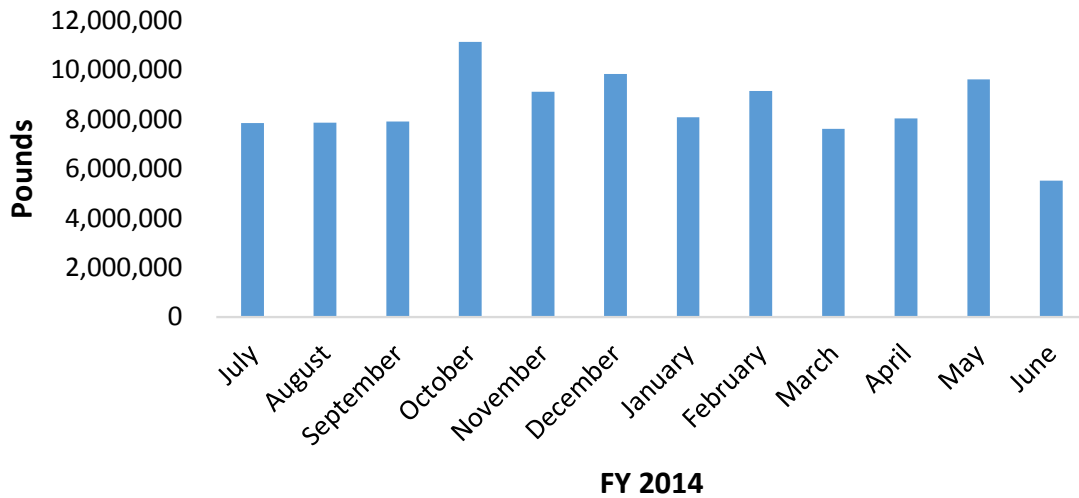
**Table 1.6-10. Monthly Average Total Suspended Solids Concentrations (mg/L) received at the Water Quality Treatment Centers in FY2014**

Year	Month	Cedar Creek	Floyds Fork	Hite Creek	Derek R. Guthrie	Morris Forman
2013	July	258	321	320	320	229
2013	August	221	386	270	270	340
2013	September	204	358	228	228	348
2013	October	207	303	232	232	412
2013	November	147	285	243	243	349
2013	December	165	258	204	204	276
2014	January	152	274	-	-	266
2014	February	168	287	237	237	286
2014	March	213	398	-	-	277
2014	April	193	363	268	268	201
2014	May	376	393	204	204	277
2014	June	638	449	277	277	228

**Table 1.6-11. Estimated Total Suspended Solids Loadings (pounds) Received at the Water Quality Treatment Centers in FY2014**

Year	Month	Cedar Creek	Floyds Fork	Hite Creek	West County	Morris Forman	Total TSS
2013	July	211,833	189,750	261,180	261,180	6,937,460	7,861,403
2013	August	124,979	176,145	308,654	308,654	6,957,967	7,876,399
2013	September	149,639	187,328	239,380	239,380	7,099,224	7,914,950
2013	October	194,014	199,586	321,878	321,878	10,098,928	11,136,282
2013	November	146,634	189,184	213,412	213,412	8,365,092	9,127,735
2013	December	203,977	214,698	241,331	241,331	8,938,102	9,839,438
2014	January	162,933	190,011	230,495	230,495	7,282,442	8,096,377
2014	February	193,165	205,074	198,373	198,373	8,355,881	9,150,865
2014	March	205,651	249,100	219,174	219,174	6,725,639	7,618,737
2014	April	242,095	325,040	250,112	250,112	6,982,022	8,049,381
2014	May	412,021	337,728	234,047	234,047	8,400,142	9,617,986
2014	June	411,838	269,389	238,228	238,228	4,366,541	5,524,223
<b>Total FY2014</b>		<b>2,658,778</b>	<b>2,733,032</b>	<b>2,956,263</b>	<b>2,956,263</b>	<b>90,509,440</b>	<b>101,813,777</b>

### Estimated TSS Loadings Received at MSD's WWTPs



**Figure 1.6-7. Total Estimated Total Suspended Solids Loadings (pounds) Received at MSD's Water Quality Treatment Centers in FY2014**

Table 1.6-12 summarizes the monthly average BOD concentrations (mg/L) received at the WQTCs in FY2014. Table 1.6-13 summarizes monthly BOD loadings by WQTC for raw influent received. Figure 1.6-8 summarizes monthly BOD loading for WQTCs, excluding developer-built systems.

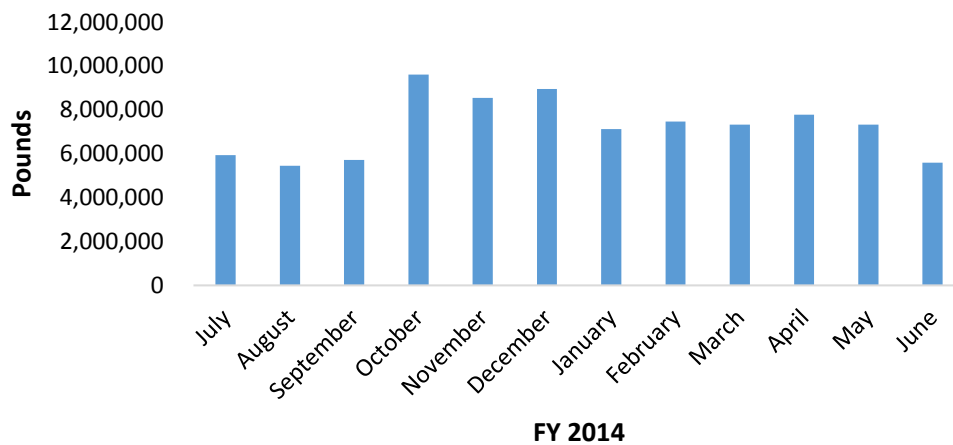
**Table 1.6-12. Monthly Average Biochemical Oxygen Demand Concentrations (mg/L) received at the Water Quality Treatment Centers in FY2014**

Year	Month	Cedar Creek	Floyds Fork	Hite Creek	Derek R. Guthrie	Morris Forman
2013	July	91	126	116	116	183
2013	August	107	152	176	176	245
2013	September	96	126	143	143	261
2013	October	104	127	218	218	364
2013	November	67	130	185	185	334
2013	December	94	145	195	195	254
2014	January	89	130	132	132	243
2014	February	87	132	110	110	239
2014	March	104	182	146	146	279
2014	April	88	170	111	111	207
2014	May	159	174	126	126	220
2014	June	240	199	167	167	262

**Table 1.6-13. Estimated Biochemical Oxygen Demand Loadings (pounds) Received at the Water Quality Treatment Centers in FY2014**

Year	Month	Cedar Creek	Floyds Fork	Hite Creek	West County	Morris Forman	Total BOD Loadings
2013	July	74,736	74,353	126,121	126,121	5,536,476	5,937,808
2013	August	60,605	69,385	149,511	149,511	5,021,091	5,450,102
2013	September	70,576	65,847	129,129	129,129	5,320,677	5,715,359
2013	October	97,907	83,669	242,543	242,543	8,941,553	9,608,216
2013	November	66,833	86,597	196,315	196,315	8,009,793	8,555,852
2013	December	115,734	120,789	247,359	247,359	8,222,009	8,953,250
2014	January	96,059	90,233	152,376	152,376	6,642,053	7,133,098
2014	February	99,794	94,081	134,730	134,730	7,005,900	7,469,236
2014	March	100,575	113,958	161,219	161,219	6,789,924	7,326,895
2014	April	109,777	152,227	163,384	163,384	7,194,161	7,782,933
2014	May	174,584	149,504	167,208	167,208	6,667,943	7,326,446
2014	June	155,138	119,439	158,766	158,766	5,011,004	5,603,113
<b>Total FY2014</b>		<b>1,222,319</b>	<b>1,220,083</b>	<b>2,028,661</b>	<b>2,028,661</b>	<b>80,362,583</b>	<b>86,862,307</b>

**Estimated BOD Loadings Received at MSD's WWTPs**



**Figure 1.6-8. Total Estimated Biochemical Oxygen Demand Loadings (pounds) Received at MSD's Water Quality Treatment Centers during FY2014**



## 6.7 CUSTOMER CHARACTERISTICS

On behalf of MSD, LWC includes wastewater and drainage-stormwater on the water bill; therefore, MSD tracks both wastewater and drainage-stormwater customers. It is possible for some customers to receive sewer service only. In addition, some customers receive drainage-stormwater services only. For billing purposes, customers are categorized into the following account types: residential, commercial, and industrial.

The commercial-account type includes Metro Government and multifamily properties. These customers are identified based on the premise type code in the LWC Customer Care and Billing system. Since wastewater service is provided to Metro Government without charge as “payment in lieu of taxes,” Metro Government properties are identified based on premise type. All customers are assigned either a monthly or bimonthly billing cycle. Most residential customers are billed bimonthly, while most C/I customers are billed monthly. The billing cycle is identified based on bill cycle code in the LWC Customer Care and Billing system.

Each customer that receives water service from LWC is assigned a connection (meter size), which is tracked in the Customer Care and Billing system. The connection size can range from a 5/8-inch up to a 10-inch water meter. Table 1.6-14 summarizes the customer count at the end of FY 2014, by connection size, account type, and bill cycle. This information is used to estimate service charge revenues and is also used to allocate customer and billing costs. Since the rate structure only distinguishes monthly and bimonthly for purposes of the service charge, “sewer only” and “optional” categories are not used to summarize the count of customers because these categories are used for volume charge purposes.

**Table 1.6-14. Customer Count by Connection Size, Account Type, and Bill Cycle FY2014**

Account Type	Residential		Commercial		Industrial		Metro		Total
	Monthly	Bimonthly	Monthly	Bimonthly	Monthly	Bimonthly	Monthly	Bimonthly	
<b>Meter Size (inches)</b>									
5/8	5,160	85,614	243	3,513	20	20	2	17	<b>94,589</b>
5/8 X 3/4	6,447	106,980	368	5,325	25	25	1	51	<b>119,222</b>
3/4	268	4,452	60	868	7	7		12	<b>5,674</b>
1	111	1,846	284	4,101	35	35		69	<b>6,481</b>
1-1/2	6	96	130	1,877	28	27	5	70	<b>2,239</b>
2	2	29	127	1,838	38	38	6	78	<b>2,156</b>
3	-	-	30	438	15	15	12	19	<b>529</b>
4	-	-	15	220	21	21	2	13	<b>292</b>
6	-	-	5	70	16	16	8	6	<b>121</b>
8	-	-	-	6	5	5	1		<b>17</b>
10	-	-	-	-	1	-			<b>1</b>
<b>Total Active</b>	<b>11,994</b>	<b>199,017</b>	<b>1,262</b>	<b>18,256</b>	<b>211</b>	<b>209</b>	<b>37</b>	<b>335</b>	<b>231,321</b>

For billing purposes, a customer’s billed sewer flows can be classified as regular or optional. All flows not categorized as optional are regular flows. Customers that have flows that are eligible as “optional” (for example, “...average water use or wastewater discharged to the public sewer during any consecutive twelve-month period exceeds 1,000,000 gallons per month.”) pay the optional volume rate based on actual flows. Table 1.6-15 summarizes billed sewer flows by rate category and account type. Flows for regular-water and optional-water rate categories are based on billed water measured by LWC. A credit (discount) is applied by MSD to adjust for billed water that does not enter the public sewer system. A credit of 15 percent is applied for residential, 10 percent for commercial, and 5 percent for industrial customers. Flows for the sewer-only rate category are based on PMs.

**Table 1.6-15. Billed Sewer Flows (million gallons) by Rate Category by Account Type FY2014**

	Residential	Commercial	Industrial	Metro	Total
<b>Regular</b>					
Water (adjusted for discounts)	11,254	9,573	188	941	21,957
Sewer Only	0.078	499	261	-	760
<b>Optional</b>					
Water (adjusted for discounts)	-	595	1,101	-	1,695
Sewer Only	-	202	1,774	-	1,975
<b>Total</b>	11,255	10,869	3,323	941	26,387

For all regular strength flows, loadings are estimated based on normal strength flows for two conventional pollutants: 250 mg/L for BOD and 270 mg/L for TSS. C/I flows that are discharged to the public sewer and are characterized as excess strength are subject to quality charges. Excess strength discharges are determined relative to normal strength discharges. Table 1.6-16 summarizes BOD loadings and Table 1.6-17 summarizes TSS loadings by rate category and account type. Normal strength loadings are based on the flows, normal strength concentrations, and 8.34 conversion factor. Excess loadings are estimated based on quality charge revenues and rates.

**Table 1.6-16. Estimated Biochemical Oxygen Demand Loadings (pounds) by Rate Category by Account Type FY2014**

Account Type	Residential	Commercial	Industrial	Metro	Total
<b>Normal Strength</b>					
Regular					
Water (adjusted for discounts)	23,465,589	19,960,043	391,825	1,962,986	45,780,442
Sewer Only	163	1,040,451	543,273	-	1,583,888
Optional					
Water (adjusted for discounts)	-	1,239,962	2,294,655	-	3,534,617
Sewer Only	-	420,435	3,697,862	-	4,118,297



**Table 1.6-16. Estimated Biochemical Oxygen Demand Loadings (pounds) by Rate Category by Account Type  
FY2014**

Account Type	Residential	Commercial	Industrial	Metro	Total
<b>Excess Strength</b>					
Regular	-	162,267	101,214	-	263,481
Optional	-	693,724	1,785,948	-	2,479,671
Sewer Only-Regular	-	106,253	1,100,394	-	1,206,646
Sewer Only-Optional	-	444,780	13,974,993	-	14,419,773
<b>Total</b>	23,465,752	24,067,914	23,890,164	1,962,986	73,386,816

**Table 1.6-17. Estimated Total Suspended Solids Loadings (pounds) by Rate Category by Account Type FY 2014**

Account Type	Residential	Commercial	Industrial	Metro	Total
<b>Normal Strength</b>					
Regular					
Water (adjusted for discounts)	25,342,836	21,556,846	423,171	2,120,025	49,442,878
Sewer Only	176	1,123,687	586,735	-	1,710,599
Optional					
Water (adjusted for discounts)	-	1,339,159	2,478,227	-	3,817,386
Sewer Only	-	454,070	3,993,691	-	4,447,761
<b>Excess Strength</b>					
Regular	-	15,341	167,516	-	182,857
Optional	-	516,916	1,629,723	-	2,146,639
Sewer Only-Regular	-	167,242	294,080	-	461,323
Sewer Only-Optional	-	282,425	13,014,847	-	13,297,272
<b>Total</b>	25,343,013	25,455,687	22,587,991	2,355,583	75,506,715

Table 1.6-18 provides the estimated ESUs and impervious area for drainage and nondrainage service areas. This information is used to evaluate unit Cost of Service and rates related to drainage-stormwater and flood protection.



**Table 1.6-18. Estimated Equivalent Service Units and Impervious Area FY2014**

	Customers <sup>a</sup>	Impervious Area (square feet)	ESUs <sup>b</sup>
<b>Drainage-Stormwater</b>			
Class A – Residential	126,000	N/A	222,755
Class B -- Commercial	10,000	897,002,549	358,801
Class B – Metro		34,926,817	13,971
Class B – Industrial		100,008,135	40,003
<b>Total Drainage-Stormwater</b>	<b>136,000</b>		<b>635,530</b>
<b>Flood Protection</b>			
Drainage			
Residential	126,000		222,755
Commercial	10,000		358,801
Metro			13,971
Industrial			40,003
<b>Total Drainage</b>	<b>136,000</b>		<b>635,530</b>
<b>Non-Drainage<sup>c</sup></b>			
Residential	9,160		9,160
Commercial	2,504	108,672,019	43,469
Industrial	279	12,116,003	4,846
<b>Total Non-Drainage</b>	<b>11,943</b>		<b>57,475</b>
<b>Total Flood Protection</b>	<b>147,943</b>		<b>693,005</b>

<sup>a</sup> Drainage monthly data.xlsx

<sup>b</sup> Official Statement to Series 2014 bonds, except flood protection.

<sup>c</sup> MSD/LOJIC GIS analysis only.

GIS geographic information system

N/A not applicable

## 6.8 RATE BASE

Rate base represents the value of the wastewater system and is most commonly used to determine rate of return. Alternatively, rate base can be used as a means of allocating equity funded capital and debt service costs. Rate base considers the fixed assets, which represent the investment in the wastewater treatment system. The portion of the system that is in operation and providing service is commonly referred to as “plant in service” for Cost of Service purposes and includes conveyance and drainage systems. Over time the condition of the assets decreases because of numerous factors and represents the accumulated depreciation. To maintain healthy financial conditions, working capital is necessary so



that cash is available to pay for day-to-day services, materials, and supplies. Rate base includes the following: Plant in Service (Gross), Accumulated Depreciation, Working Capital, and Work in Progress.

Plant in service represents the value of assets that are in use and are providing service to the customers. For the FY ending June 30, 2014, the value of plant in service was approximately \$2.8 billion.

Table 1.6-19 summarizes plant in service by asset type for FY2014. Accumulated depreciation represents the monetary value of how much an asset has expired since placed into service. It is used to determine the book value of assets that are in service. For the FY ending June 30, 2014, the value of plant in service was approximately \$946.4 million. Table 1.6-20 summarizes accumulated depreciation by asset type for FY2014. Working capital includes prepaid items such as insurance policies and maintenance agreement, and an inventory of materials and supplies. It also includes an allowance for operating reserve, typically based on a fraction of annual O&M. Based on FY2014 financial data, working capital was \$5.4 million.

Construction work in progress (CWIP) recognizes the costs associated with financing capital projects, which are under construction and not yet in service. Since MSD is not subject to Public Utility Commission review, it is assumed that CWIP is allowed and represents a benefit to current ratepayers. Based on FY2014 financial data, CWIP was \$463.2 million. Rate base for FY2014 is estimated to be \$2.3 billion and is calculated based on the following: Rate Base = Gross Plant in Service – Accumulated Depreciation + Working Capital + CWIP.

**Table 1.6-19. Summary of Gross Plant in Service for FY2014**

Account Number	Asset Type	FY2014
17100	Sewer Lines	\$1,274,179,744
17200	Pump Stations	\$96,818,703
17300	Wastewater Treatment Facilities	\$488,407,487
17400	Administrative Facilities	\$49,341,678
17460	Stormwater Construction Assets	\$448,899,268
17500	Maintenance Facilities	\$8,037,305
17800	Fleet	\$32,034,575
17820	Radio Communication	\$1,300,004
17840	Data Processing Hardware	\$1,755,500
17860	Data Processing Programs	\$21,518,326
17880	Telephone System	\$381,723
17900	LOJIC Equipment - Installed Cost	\$1,344,787
17920	Miscellaneous Assets	\$27,060,412
17960	Capitalized Interest	\$301,800,261
18225	Goodwill Plant Acquisition	\$881,975
	<b>Total</b>	<b>\$2,753,761,748</b>

Source: MSD (2015).

**Table 1.6-20. Summary of Accumulated Depreciation FY2014**

Account Number	Asset Type	FY2014
17110	Sewer Lines	\$271,417,810
17210	Pump Stations	\$46,147,367
17310	Wastewater Treatment Facilities	\$325,848,885
17410	Administrative Facilities	\$32,215,886
17470	Stormwater Construction Assets	\$119,716,587
17510	Maintenance Facilities	\$5,725,208
17810	Fleet	\$28,293,267
17830	Radio Communication	\$214,257
17850	Data Processing Hardware	\$1,526,862
17870	Data Processing Programs	\$21,187,362
17890	Telephone System	\$381,723
17910	LOJIC Equipment – Installed Cost	\$812,847
17930	Miscellaneous Assets	\$17,309,167
17970	Capitalized Interest	\$75,013,979
18230	Goodwill Plant Acquisition	\$615,205
	<b>Total</b>	<b>\$946,426,412</b>

Source: MSD (2015).

To use rate base as an allocation factor, the cost classifications identified in Section 6.4 are used. Table 1.6-21 summarizes the allocation percentages for each asset type, which are set-based approximations of the cost causation and/or use of facilities. Table 1.6-22 summarizes the allocation of rate base to cost components. Working capital and CWIP are allocated-based percentages or plant in service. The cost classification percentages for rate base can be used in allocation of equity-funded capital and debt service costs.



**Table 1.6-21. Classification of Plant in Service to Cost Components FY2014**

<b>Asset Type</b>	<b>Flow</b>	<b>BOD</b>	<b>TSS</b>	<b>IWD</b>	<b>Customer Service</b>	<b>Billing</b>	<b>Drainage-Stormwater</b>	<b>Flood Protection</b>	<b>Indirect</b>
Sewer Lines	69%				30%			1%	
Pump Stations	82%							18%	
Wastewater Treatment Facilities		50%	50%						
Administrative Facilities								2%	98%
Stormwater Construction Assets							78%	22%	
Maintenance Facilities	70%						30%		
Fleet									100%
Radio Communication									100%
Data Processing Hardware						20%			80%
Data Processing Programs						20%			80%
Telephone System									100%
LOJIC Equipment – Installed Cost					100%				
Miscellaneous Assets									100%
Capitalized Interest									100%
Goodwill Plant Acquisition									100%



**Table 1.6-22. Allocation of Rate Base to Cost Components (Thousands of Dollars) FY2014**

Acct.	Asset Type	FY2014	Flow	BOD	TSS	IWD	Customer Service	Billing	Drainage Storm-water	Flood Protection	Indirect	Basis of Classification
<b>Plant in Service</b>												
17100	Sewer Lines	\$1,274.2	\$879.2	-	-	-	\$382.3	-	-	\$12.7	-	69% Flow, 30% Customer, 1% Flood
17200	Pump Stations	\$96.8	\$79.4	-	-	-	-	-	-	\$17.4	-	82% Flow, 18% Flood
17300	Wastewater Treatment Facilities	\$488.4	-	\$244.2	\$244.2	-	-	-	-	-	-	50% BOD, 50% TSS
17400	Administrative Facilities	\$49.3	-	-	-	-	-	-	-	\$1.0	\$48.4	2% Flood, 98% Indirect
17460	Stormwater Construction Assets	\$448.9	-	-	-	-	-	-	\$350.1	\$98.8	-	78% Drainage—Stormwater, 22% Flood Protection
17500	Maintenance Facilities	\$8.0	\$5.6	-	-	-	-	-	\$2.4	-	-	70% Flow, 30% Drainage—Stormwater
17800	Fleet	\$32.0	-	-	-	-	-	-	-	-	\$32.0	100% Indirect
17820	Radio Communication	\$1.3	-	-	-	-	-	-	-	-	\$1.3	100% Indirect
17840	Data Processing Hardware	\$1.8	-	-	-	-	-	\$0.4	-	-	\$1.4	20% Billing, 80% Indirect
17860	Data Processing Programs	\$21.5	-	-	-	-	-	\$4.3	-	-	\$17.2	20% Billing, 80% Indirect
17880	Telephone System	\$0.4	-	-	-	-	-	-	-	-	\$0.4	100% Indirect
17900	LOJIC Equipment – Installed Cost	\$1.3	-	-	-	-	\$1.3	-	-	-	-	100% Flow



**Table 1.6-22. Allocation of Rate Base to Cost Components (Thousands of Dollars) FY2014**

Acct.	Asset Type	FY2014	Flow	BOD	TSS	IWD	Customer Service	Billing	Drainage Storm-water	Flood Protection	Indirect	Basis of Classification
17920	Miscellaneous Assets	\$27.1	-	-	-	-	-	-	-	-	\$27.1	100% Indirect
17960	Capitalized Interest	\$301.8	-	-	-	-	-	-	-	-	\$301.8	100% Indirect
18225	Goodwill Plant Acquisition	\$0.9	-	-	-	-	-	-	-	-	\$0.9	100% Flow
<b>Total Before Reallocation of Indirect</b>		<b>\$2,753.8</b>	<b>\$964.2</b>	<b>\$244.2</b>	<b>\$244.2</b>	<b>-</b>	<b>\$383.6</b>	<b>\$4.7</b>	<b>\$352.6</b>	<b>\$129.9</b>	<b>\$430.4</b>	
<b>Percent</b>			<b>35.01%</b>	<b>8.87%</b>	<b>8.87%</b>	<b>-</b>	<b>13.93%</b>	<b>0.17%</b>	<b>12.80%</b>	<b>4.72%</b>	<b>15.63%</b>	
<b>Reallocation of Indirect: Plant in Service</b>			<b>\$178.6</b>	<b>\$45.2</b>	<b>\$45.2</b>	<b>-</b>	<b>\$71.1</b>	<b>\$0.9</b>	<b>\$65.3</b>	<b>\$24.1</b>	<b>(\$430.4)</b>	
<b>Total Plant in Service</b>		<b>\$2,753.8</b>	<b>\$1,142.8</b>	<b>\$289.4</b>	<b>\$289.4</b>	<b>-</b>	<b>\$454.7</b>	<b>\$5.5</b>	<b>\$417.9</b>	<b>\$154.0</b>	<b>-</b>	
<b>% of Total Plant in Service</b>			<b>41.50%</b>	<b>10.51%</b>	<b>10.51%</b>	<b>-</b>	<b>16.51%</b>	<b>0.20%</b>	<b>15.17%</b>	<b>5.59%</b>	<b>-</b>	<b>Plant in Service Factor</b>
<b>Less: Accumulated Depreciation</b>												
17110	Sewer Lines	(\$271.4)	(\$187.3)	-	-	-	(\$81.4)	-	-	(\$2.7)	-	69% Flow, 30% Customer, 1% Flood
17210	Pump Stations	(\$46.1)	(\$37.8)	-	-	-	-	-	-	(\$8.3)	-	82% Flow, 18% Flood
17310	Wastewater Treatment Facilities	(\$325.8)	-	(\$162.9)	(\$162.9)	-	-	-	-	-	-	50% BOD, 50% TSS
17410	Administrative Facilities	(\$32.2)	-	-	-	-	-	-	-	(\$0.6)	(\$31.6)	2% Flood, 98% Indirect
17470	Stormwater Construction Assets	(\$119.7)	-	-	-	-	-	-	(\$93.4)	(\$26.3)	-	78% Drainage-Stormwater, 22% Flood



**Table 1.6-22. Allocation of Rate Base to Cost Components (Thousands of Dollars) FY2014**

Acct.	Asset Type	FY2014	Flow	BOD	TSS	IWD	Customer Service	Billing	Drainage Storm-water	Flood Protection	Indirect	Basis of Classification
17510	Maintenance Facilities	(\$5.7)	(\$4.0)	-	-	-	-	-	(\$1.7)	-	-	70% Flow, 30% Drainage-Stormwater
17810	Fleet	(\$28.3)	-	-	-	-	-	-	-	-	(\$28.3)	100% Indirect
17830	Radio Communication	(\$0.2)	-	-	-	-	-	-	-	-	(\$0.2)	100% Indirect
17850	Data Processing Hardware	(\$1.5)	-	-	-	-	-	(\$0.3)	-	-	(\$1.2)	20% Billing, 80% Indirect
17870	Data Processing Programs	(\$21.2)	-	-	-	-	-	(\$4.2)	-	-	(\$16.9)	20% Billing, 80% Indirect
17890	Telephone System	(\$0.4)	-	-	-	-	-	-	-	-	(\$0.4)	100% Indirect
17910	LOJIC Equipment - Installed Cost	(\$0.8)	-	-	-	-	(\$0.8)	-	-	-	-	100% Flow
17930	Miscellaneous Assets	(\$17.3)	-	-	-	-	-	-	-	-	(\$17.3)	100% Indirect
17970	Capitalized Interest	(\$75.0)	-	-	-	-	-	-	-	-	(\$75.0)	100% Indirect
18230	Goodwill Plant Acquisition	(\$0.6)	-	-	-	-	-	-	-	-	(\$0.6)	100% Flow
<b>Total Before Reallocation of Indirect</b>		<b>(\$946.4)</b>	<b>(\$229.1)</b>	<b>(\$162.9)</b>	<b>(\$162.9)</b>	<b>-</b>	<b>(\$82.2)</b>	<b>(\$4.5)</b>	<b>(\$95.1)</b>	<b>(\$38.0)</b>	<b>(\$171.6)</b>	
<b>Percent</b>			<b>24.21%</b>	<b>17.21%</b>	<b>17.21%</b>	<b>-</b>	<b>8.69%</b>	<b>0.48%</b>	<b>10.05%</b>	<b>4.02%</b>	<b>18.13%</b>	
<b>Reallocation of Indirect: Accumulated Depreciation</b>			<b>(\$71.2)</b>	<b>(\$18.0)</b>	<b>(\$18.0)</b>	<b>-</b>	<b>(\$28.3)</b>	<b>(\$0.3)</b>	<b>(\$26.0)</b>	<b>(\$9.6)</b>	<b>\$171.6</b>	
<b>Total Accumulated Depreciation</b>		<b>(\$946.4)</b>	<b>(\$300.3)</b>	<b>(\$181.0)</b>	<b>(\$181.0)</b>	<b>-</b>	<b>(\$110.6)</b>	<b>(\$4.9)</b>	<b>(\$121.1)</b>	<b>(\$47.6)</b>	<b>-</b>	
<b>Plus: Working Capital</b>												
152*	Prepaid Items	\$1.4	\$0.6	\$0.2	\$0.2	-	\$0.2	\$0.0	\$0.2	\$0.1	-	as Plant in Service



**Table 1.6-22. Allocation of Rate Base to Cost Components (Thousands of Dollars) FY2014**

Acct.	Asset Type	FY2014	Flow	BOD	TSS	IWD	Customer Service	Billing	Drainage Storm-water	Flood Protection	Indirect	Basis of Classification
165*	Inventories	\$3.8	\$1.6	\$0.4	\$0.4	-	\$0.6	\$0.0	\$0.6	\$0.2	-	as Plant in Service
	Operating Reserve	\$0.1	\$0.0	\$0.0	\$0.0	-	\$0.0	\$0.0	\$0.0	\$0.0	-	as Plant in Service
<b>Total Working Capital</b>		<b>\$5.4</b>	<b>\$2.2</b>	<b>\$0.6</b>	<b>\$0.6</b>	<b>-</b>	<b>\$0.9</b>	<b>\$0.0</b>	<b>\$0.8</b>	<b>\$0.3</b>	<b>-</b>	
<b>Plus: CWIP</b>												
18410	Construction in Progress	\$463.2	\$192.2	\$48.7	\$48.7	-	\$76.5	\$0.9	\$70.3	\$25.9	-	as Plant in Service
<b>Total CWIP</b>		<b>\$463.2</b>	<b>\$192.2</b>	<b>\$48.7</b>	<b>\$48.7</b>	<b>-</b>	<b>\$76.5</b>	<b>\$0.9</b>	<b>\$70.3</b>	<b>\$25.9</b>	<b>-</b>	
<b>Total Rate Base</b>		<b>\$2,275.9</b>	<b>\$1,036.9</b>	<b>\$157.7</b>	<b>\$157.7</b>	<b>-</b>	<b>\$421.5</b>	<b>\$1.6</b>	<b>\$367.8</b>	<b>\$132.6</b>	<b>-</b>	
<b>% Rate Base</b>			<b>45.56%</b>	<b>6.93%</b>	<b>6.93%</b>	<b>-</b>	<b>18.52%</b>	<b>0.07%</b>	<b>16.16%</b>	<b>5.83%</b>	<b>-</b>	<i>Rate Base Factor</i>

## **6.9 REVENUE REQUIREMENTS**

The revenue requirements represent the program costs (sewer system, CSO, drainage-stormwater, and flood protection) to be recovered by operating revenues. Program costs include O&M, debt service, and equity-funded capital projects (cash capital). Lastly, non-rate revenues are deducted to determine net revenue requirements. As previously discussed in Section 6.4, the test year for the Cost of Service analysis is FY2014. Therefore, the program costs for FY2014 were used in this analysis. O&M costs by cost center were evaluated and allocated to cost components. In cases where a cost center could not be directly assigned to a cost component, the cost center was allocated as indirect and then reallocated to components based on the total for O&M. Cost center details were used to facilitate allocation to cost components and then summarized by operating department/group.

Existing debt obligations were evaluated to identify particular use of bond proceeds, which would inform the allocation of debt service to cost components. Because the bond proceeds were used for various purposes, the particular details were not readily available to inform the allocation to cost components. Therefore, debt service costs were allocated according the allocations for rate base (see Table 1.6-22), which is a reasonable proxy for allocated capital-related expenditures.

In general, non-rate revenues were allocated to cost components based on total O&M excluding flood protection. Non-rate revenues are not allocated to flood protection because non-rate revenues are unrelated to flood protection activities and relate to ancillary activities of wastewater treatment and drainage-stormwater services. There were several exceptions in which a direct allocation could be made.

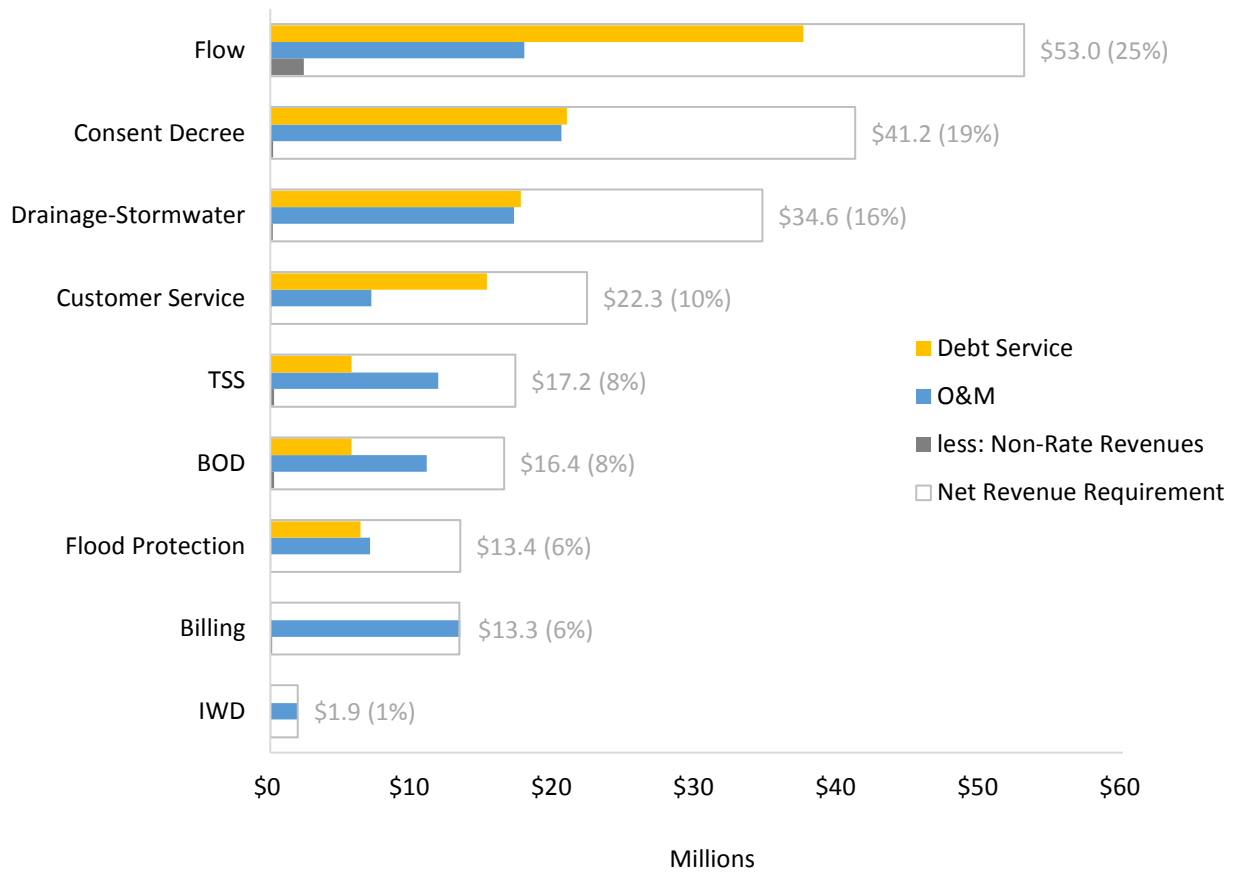
The revenue requirements presented in this section do not include costs associated with I/I because these costs are considered as part of the cost of service allocations (Section 6.9). As I/I is neither a cost center nor treated as a cost component, the costs associated with I/I are estimated based on unit Cost of Service for flow, BOD, and TSS; and then reallocated to customer classes for flow and drainage-stormwater cost components. This is consistent with MSD past practice in I/I cost allocation.

In 2009, MSD implemented the EPA Consent Decree surcharge, which was structured to recover 30 percent of the sewer costs. While the particular sewer costs were not defined, for this Cost of Service analysis, it is assumed that 30 percent of the O&M and debt service costs distributed flow, BOD, TSS, and customer service are allocated to the Consent Decree cost component. This provides transparent recognition of the costs related to the EPA Consent Decree that can be used to develop a Cost of Service rate. The costs associated with the Consent Decree represent approximately 19 percent of the total revenue requirements.

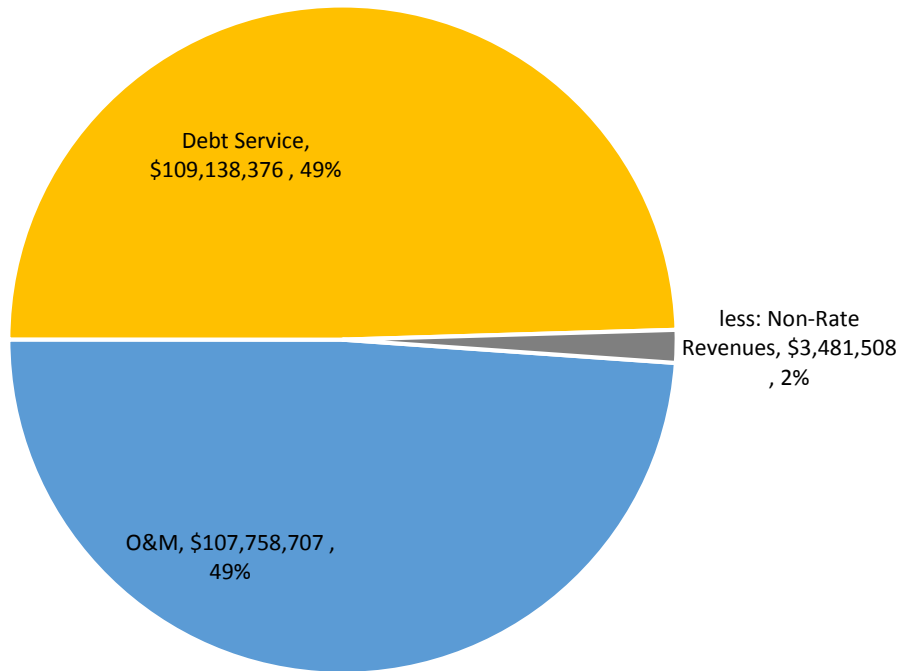
Figure 1.6-9 presents dollar and percentage of the net revenue requirements by cost type and cost component (sorted descending) before the determination and reallocation of I/I costs, which is presented later in this section. The largest allocation by cost component is flow and the smallest allocation is IWD. Figure 1.6-10 presents the dollar amount and percentage by cost type, which shows that the largest portion of the net revenues requirements is allocated to debt service. Table 1.6-23 presents the dollar allocations of O&M by cost components, Table 1.6-24 presents the dollar allocations

of debt service by cost components, and Table 1.6-25 presents the dollar allocations of non-rate revenues by cost components.

**Net Revenue Requirements for Test Year FY2014**



**Figure 1.6-9. Net Revenue Requirements Before Reallocation of Infiltration and Inflow Costs (Test Year = FY2014)**



**Figure 1.6-10. Distribution of Net Revenue Requirements by Cost Type (Test Year = FY2014)**



**Table 1.6-23. Test Year Operations and Maintenance Costs Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Indirect	Test Year (FY2014)
<b>Allocation Percentages</b>											
Collections System	28%	5%	5%	-	30%	-	29%	3%	-	-	
Drainage & Flood Protection	0%	-	-	-	-	-	0%	61%	39%	-	
Engineering	16%	13%	13%	-	-	-	18%	35%	5%	-	
Executive Offices	-	-	-	-	-	10%	-	8%	-	83%	
Finance	-	-	-	-	-	57%	-	13%	-	30%	
Human Resource	-	-	-	-	-	7%	-	-	-	93%	
Information Technology	-	-	-	-	-	33%	-	1%	-	65%	
Legal Services	-	-	-	-	-	18%	-	-	-	82%	
Overhead	-	-	-	-	-	20%	-	-	-	80%	
Performance Matrix	-	-	-	-	-	-	-	-	-	100%	
Support Services	7%	1%	1%	13%	-	-	3%	7%	-	69%	
Treatment Facilities	18%	17%	19%	1%	-	-	23%	-	-	22%	
Allocation of Indirect	17%	10%	11%	2%	7%	12%	16%	19%	7%	-	
<b>Allocated O&amp;M</b>											
Collections System	\$4,559	\$879	\$875	-	\$4,979	-	\$4,840	\$414	-	-	\$16,547
Drainage and Flood Protection	\$28	-	-	-	-	-	\$12	\$7,365	\$4,654	-	\$12,060
Engineering	\$977	\$774	\$774	-	-	-	\$1,082	\$2,070	\$269	-	\$5,945
Executive Offices	-	-	-	-	-	\$410	-	\$327	-	\$3,547	\$4,284



**Table 1.6-23. Test Year Operations and Maintenance Costs Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Indirect	Test Year (FY2014)
Finance	-	-	-	-	-	\$5,644	-	\$1,242	-	\$2,950	\$9,836
Human Resource	-	-	-	-	-	\$358	-	-	-	\$4,822	\$5,180
Information Technology	-	-	-	-	-	\$2,282	-	\$99	-	\$4,433	\$6,814
Legal Services	-	-	-	-	-	\$317	-	-	-	\$1,448	\$1,765
Overhead	-	-	-	-	-	\$367	-	-	-	\$1,467	\$1,834
Performance Matrix	-	-	-	-	-	-	-	-	-	\$440	\$440
Support Services	\$521	\$52	\$52	\$1,042	-	-	\$268	\$521	-	\$5,417	\$7,874
Treatment Facilities	\$6,454	\$6,024	\$6,578	\$321	-	-	\$8,167	-	-	\$7,637	\$35,180
O&M before Reallocation of Indirect	\$12,539	\$7,730	\$8,279	\$1,363	\$4,979	\$9,378	\$14,368	\$12,038	\$4,923	\$32,162	\$107,759
Percent	16.60%	10.20%	11.00%	1.80%	6.60%	12.40%	19.00%	15.90%	6.50%		
Reallocation of Indirect	\$5,339	\$3,280	\$3,538	\$579	\$2,123	\$3,988	\$6,111	\$5,114	\$2,091	(\$32,162)	-
O&M after Reallocation of Indirect	\$17,877	\$11,010	\$11,817	\$1,942	\$7,102	\$13,366	\$20,479	\$17,152	\$7,013	-	\$107,759
Net O&M	\$17,877	\$11,010	\$11,817	\$1,942	\$7,102	\$13,366	\$20,479	\$17,152	\$7,013	-	\$107,759



**Table 1.6-24. Test Year Debt Service Costs Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Test Year (FY2014)
<b>Allocation Percentages</b>										
Un-refunded Series 2005A	46%	7%	7%	-	19%	0%	-	16%	6%	
Series 2006A	46%	7%	7%	-	19%	0%	-	16%	6%	
Series 2007A	46%	7%	7%	-	19%	0%	-	16%	6%	
Series 2008A	46%	7%	7%	-	19%	0%	-	16%	6%	
Series 2009A	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2009B	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2009C	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2010A	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2011A	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2013A	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2013B	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2013C	32%	5%	5%	-	13%	0%	23%	16%	6%	
Series 2014A	32%	5%	5%	-	13%	0%	23%	16%	6%	
<b>Allocated Debt Service</b>										
Un-refunded Series 2005A	\$1,395	\$212	\$212	-	\$567	\$2	-	\$495	\$178	\$3,063
Series 2006A	\$2,921	\$444	\$444	-	\$1,187	\$4	-	\$1,036	\$373	\$6,410
Series 2007A	\$2,168	\$330	\$330	-	\$881	\$3	-	\$769	\$277	\$4,759
Series 2008A	\$2,555	\$389	\$389	-	\$1,039	\$4	-	\$906	\$327	\$5,608
Series 2009A	\$2,642	\$402	\$402	-	\$1,074	\$6	\$1,937	\$1,339	\$483	\$8,285
Series 2009B	\$7,225	\$1,099	\$1,099	-	\$2,936	\$16	\$5,297	\$3,661	\$1,320	\$22,653



**Table 1.6-24. Test Year Debt Service Costs Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Test Year (FY2014)
Series 2009C	\$3,433	\$522	\$522	-	\$1,395	\$7	\$2,517	\$1,740	\$627	\$10,764
Series 2010A	\$6,578	\$1,001	\$1,001	-	\$2,674	\$14	\$4,823	\$3,333	\$1,202	\$20,625
Series 2011A	\$4,689	\$713	\$713	-	\$1,906	\$10	\$3,437	\$2,376	\$856	\$14,701
Series 2013A	\$1,453	\$221	\$221	-	\$590	\$3	\$1,065	\$736	\$265	\$4,554
Series 2013B	\$1,590	\$242	\$242	-	\$646	\$3	\$1,165	\$806	\$290	\$4,984
Series 2013C	\$872	\$133	\$133	-	\$354	\$2	\$639	\$442	\$159	\$2,733
Series 2014A	-	-	-	-	-	-	-	-	-	-
<b>Existing Debt Service</b>	\$37,521	\$5,707	\$5,707	-	\$15,250	\$75	\$20,880	\$17,639	\$6,358	\$109,138
<b>Net Existing Debt Service</b>	\$37,521	\$5,707	\$5,707	-	\$15,250	\$75	\$20,880	\$17,639	\$6,358	\$109,138



**Table 1.6-25. Test Year Non-Rate Revenues Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Test Year (FY2014)
<b>Allocation Percentage</b>										
Cash Discount Received	18%	11%	12%	-	7%	14%	21%	17%	-	
Proceeds from Sale of Assets	18%	11%	12%	-	7%	14%	21%	17%	-	
Misc. Income – Recovery	18%	11%	12%	-	7%	14%	21%	17%	-	
Fines & Recoveries	18%	11%	12%	-	7%	14%	21%	17%	-	
Louisville Green Revenue	-	50%	50%	-	-	-	-	-	-	
Property Owners Recovery	18%	11%	12%	-	7%	14%	21%	17%	-	
I/I Fees	100%	-	-	-	-	-	-	-	-	
Hazard Material Permit Fee	18%	11%	12%	-	7%	14%	21%	17%	-	
Misc. Mapping Fees	18%	11%	12%	-	7%	14%	21%	17%	-	
Site Plan Review Fees	18%	11%	12%	-	7%	14%	21%	17%	-	
Connection Fees	18%	11%	12%	-	7%	14%	21%	17%	-	
Acquisition Surcharges	18%	11%	12%	-	7%	14%	21%	17%	-	
LOJIC Misc. Product Sales	18%	11%	12%	-	7%	14%	21%	17%	-	
Capacity Charges	100%	-	-	-	-	-	-	-	-	
Regional Facilities Fees	18%	11%	12%	-	7%	14%	21%	17%	-	
<b>Allocated Non-Rate Revenue</b>										
Cash Discount Received	\$2.0	\$1.2	\$1.3	-	\$0.8	\$1.5	\$2.3	\$1.9	-	\$11.0
Proceeds from Sale of Assets	\$0.5	\$0.3	\$0.3	-	\$0.2	\$0.4	\$0.6	\$0.5	-	\$2.9



**Table 1.6-25. Test Year Non-Rate Revenues Allocated by Cost Components (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Test Year (FY2014)
Misc. Income – Recovery	\$74.4	\$45.9	\$49.1	-	\$29.5	\$55.6	\$85.2	\$71.4	-	\$411.2
Fines & Recoveries	\$25.6	\$15.8	\$16.9	-	\$10.2	\$19.2	\$29.4	\$24.6	-	\$141.7
Louisville Green Revenue	-	\$160.9	\$160.9	-	-	-	-	-	-	\$321.7
Property Owners Recovery	\$6.9	\$4.3	\$4.6	-	\$2.7	\$5.2	\$7.9	\$6.6	-	\$38.3
I/I Fees	\$560.2	-	-	-	-	-	-	-	-	\$560.2
Hazard Material Permit Fee	\$0.4	\$0.2	\$0.3	-	\$0.2	\$0.3	\$0.5	\$0.4	-	\$2.2
Misc. Mapping Fees	\$0.2	\$0.1	\$0.1	-	\$0.1	\$0.1	\$0.2	\$0.2	-	\$1.1
Site Plan Review Fees	\$0.7	\$0.4	\$0.5	-	\$0.3	\$0.5	\$0.8	\$0.7	-	\$3.9
Connection Fees	\$24.1	\$14.9	\$15.9	-	\$9.6	\$18.0	\$27.6	\$23.1	-	\$133.3
Acquisition Surcharges	\$8.4	\$5.2	\$5.5	-	\$3.3	\$6.3	\$9.6	\$8.1	-	\$46.4
LOJIC Misc. Product Sales	\$35.8	\$22.1	\$23.6	-	\$14.2	\$26.8	\$41.0	\$34.4	-	\$197.9
Capacity Charges	\$1,619.8	-	-	-	-	-	-	-	-	\$1,619.8
Regional Facilities Fees	\$0.003	\$0.002	\$0.002	-	\$0.001	\$0.002	\$0.003	\$0.003	-	\$0.014
<b>Total Non-Rate Revenue</b>	<b>\$2,359.0</b>	<b>\$271.2</b>	<b>\$279.1</b>	<b>-</b>	<b>\$71.1</b>	<b>\$133.9</b>	<b>\$205.2</b>	<b>\$171.9</b>	<b>-</b>	<b>\$3,491.5</b>
Less: Capitalized Invest. Inc.	(\$1.8)	(\$1.1)	(\$1.2)	-	(\$0.7)	(\$1.4)	(\$2.1)	(\$1.7)	-	(\$10.0)
<b>Total Net Non-Rate Revenues</b>	<b>\$2,357.2</b>	<b>\$270.1</b>	<b>\$277.9</b>	<b>-</b>	<b>\$70.4</b>	<b>\$132.6</b>	<b>\$203.1</b>	<b>\$170.2</b>	<b>-</b>	<b>\$3,481.5</b>

## **6.10 COST OF SERVICE ALLOCATIONS**

This section presents Cost of Service allocation and rates. The starting point for Cost of Service allocation is determining systemwide unit Cost of Service, which uses units of service in Section 6.6 and revenue requirements in Section 6.8. The process of determine Cost of Service rates include the following steps:

1. Table 1.6-26 summarizes net revenue requirements and service units and presents systemwide unit Cost of Service, which determines the of Service by customer class and cost component.
2. Table 1.6-27 presents service units organized by customer type and rate and cost components For the cost component flow, the billed consumption (expressed in thousands of gallons [Kgal]) is summarized for each customer type and rate component. For the cost components BOD and TSS, estimated loadings (expressed in pounds) are summarized for each customer type and rate component. For cost components IWD, customer service, and billing, number of bills is summarized for each customer type and rate component. For cost components drainage-stormwater and flood protection, the number of ESUs is summarized for customer type.
3. Table 1.6-28 presents the Cost of Service allocation by customer type, rate component, and cost component before reallocation I/I costs. These allocations are determined by multiplying the system-wide unit Cost of Service and the units of service organized by customer type, rate component, and cost component. The estimated costs of I/I are reallocated to flow (30 percent) and drainage-stormwater (70 percent). The reallocation of I/I costs should address the flow and capacity parameters of I/I. For a system with CSOs, inflow can be attributed to the flows entering the CSO system resulting from leaks and stormwater (wet weather) because of pipes connected to the sewer system. Therefore, I/I costs are assumed to be attributed to flow and drainage-stormwater cost components. Since the pipes are sized to meet the peak flows, a portion of the costs can be attributed to the customer service cost component. Infiltration is attributed to groundwater entering the sewer pipes, which can be attributed to the drainage-stormwater cost component. The average metered volume is 76 MGD and the average measured volume received at all WQTCs is 119.5 MGD. The difference between these numbers represents estimated total I/I in the system, which is approximately 43.5 MGD. The average day in the minimum month (termed “base flow” in Kentucky state regulations) is 89 MGD. It is assumed that “base flow” represents sanitary sewage plus infiltration with a negligible amount of inflow. From this, infiltration is estimated to be 13 MGD (89 to 76). This portion of I/I is allocated to flow and not BOD or TSS components. Inflow is estimated to be 30.5 MGD (43.5 to 13). This is stormwater runoff and includes some BOD and TSS that must be treated. Therefore, cost associated with inflow is allocated to drainage-stormwater. Table 1.6-29 presents the Cost of Service after reallocation I/I costs.
4. Table 1.6-30 presents the revenue requirements by cost component by customer class after reallocation of Consent Decree costs. However, the Consent Decree applies to specific rate components within each customer class. To allocate the total Consent Decree costs to the detailed rate components for each customer class, allocation factors were developed based on flow, BOD, TSS, and customer service because these cost components provide the most reasonable basis for allocating these Consent Decree costs. The allocations presented in Table 1.6-30 are used to develop Cost of Service rates.



**Table 1.6-26. Allocation of Revenue Requirements by Cost Components and Unit Cost of Service (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage-Stormwater	Flood Protection	Test Year (FY2014)
<b>Revenue Requirement Item</b>										
Net O&M	\$17,877	\$11,010	\$11,817	\$1,942	\$7,102	\$13,366	\$20,479	\$17,152	\$7,013	\$107,759
Net Existing Debt Service	\$37,521	\$5,707	\$5,707	-	\$15,250	\$75	\$20,880	\$17,639	\$6,358	\$109,138
Equity Financed Capital Improvement Program	-	-	-	-	-	-	-	-	-	-
Less: Net Non-Rate Revenues	(\$2,357)	(\$270)	(\$278)	-	(\$70)	(\$133)	(\$203)	(\$170)	-	(\$3,482)
Net Revenue Requirements	\$53,041	\$16,448	\$17,246	\$1,942	\$22,281	\$13,309	\$41,157	\$34,621	\$13,371	\$213,416
<b>Units of Service (System-wide)</b>										
Quantity	43,621,947	86,862,307	101,813,777	420	231,321	1,468,950	231,321	635,530	693,005	
Unit Measure	Kgal	lbs	lbs	customer	customer	bill	customer	ESU	ESU	
Unit costs (\$/unit) (Annual)	\$1.26	\$0.1880	\$0.1680	\$4,623.68	\$95.54	\$8.83	\$175.68	\$53.79	\$19.29	

lbs      pounds



**Table 1.6-27. Units of Service by Customer Class FY2014**

	Flow (Kgal)	BOD (lbs)	TSS (lbs)	IWD (customer)	Customer Service (customer)	Billing (bill)	Consent Decree (customer)	Drainage- Stormwater (ESU)	Flood Protection (ESU)
<b>Residential</b>									
<b>Regular</b>									
Water <sup>a</sup>	11,254,479	23,465,589	25,342,836	-	211,011	1,338,030	211,011	222,755	231,915
Sewer Only	78	163	176	-	-	-	-	-	-
<b>Commercial</b>									
<b>Regular</b>									
Water <sup>a</sup>	9,573,162	19,960,043	21,556,846	-	19,518	124,680	19,518	358,801	402,270
Sewer Only	499,017	1,040,451	1,123,687	-	-	-	-	-	-
<b>Optional</b>									
Water <sup>a</sup>	594,706			-	-	-	-	-	-
Sewer Only	201,647			-	-	-	-	-	-
<b>Excess</b>									
Regular		162,267	15,341	-	-	-	-	-	-
Optional		1,933,686	1,856,075	-	-	-	-	-	-
Sewer Only-Regular		106,253	167,242	-	-	-	-	-	-
Sewer Only-Optional		865,215	736,495	-	-	-	-	-	-
<b>Industrial</b>									
<b>Regular</b>									
Water <sup>a</sup>	187,925	391,825	423,171	420	420	3,786	420	40,003	44,850
Sewer Only	260,563	543,273	586,735	-	-	-	-	-	-



**Table 1.6-27. Units of Service by Customer Class FY2014**

	Flow (Kgal)	BOD (lbs)	TSS (lbs)	IWD (customer)	Customer Service (customer)	Billing (bill)	Consent Decree (customer)	Drainage- Stormwater (ESU)	Flood Protection (ESU)
<b>Optional</b>									
Water <sup>a</sup>	1,100,554			-	-	-	-	-	-
Sewer Only	1,773,555			-	-	-	-	-	-
<b>Excess</b>									
Regular		101,214	167,516	-	-	-	-	-	-
Optional		4,080,603	4,107,950	-	-	-	-	-	-
Sewer Only-Regular		1,100,394	294,080	-	-	-	-	-	-
Sewer Only-Optional		17,672,855	17,008,538	-	-	-	-	-	-
<b>Metro Government</b>	941,480	1,962,986	2,120,025	-	372	2,454	372	13,971	13,971
<b>Infiltration/Inflow</b>	17,234,779	13,475,491	26,307,062	-	-	-	-	-	-
<b>Total</b>	<b>43,621,947</b>	<b>86,862,307</b>	<b>101,813,777</b>	<b>420</b>	<b>231,321</b>	<b>1,468,950</b>	<b>231,321</b>	<b>635,530</b>	<b>693,005</b>

<sup>a</sup>Based on billed water consumption and adjusted to reflect water not entering sewer system.



**Table 1.6-28. Revenue Requirements Before Reallocation of Infiltration/Inflow (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Total
<b>Residential</b>										
<b>Regular</b>										
Water	\$13,685	\$4,443	\$4,293	-	\$20,325	\$12,123	\$37,543	\$12,135	\$4,475	\$109,021
Sewer Only	\$0.10	\$0.03	\$0.03	-	-	-	-	-	-	\$0.16
<b>Commercial</b>										
<b>Regular</b>										
Water	\$11,640	\$3,779	\$3,652	-	\$1,880	\$1,130	\$3,473	\$19,546	\$7,762	\$52,861
Sewer Only	\$607	\$197	\$190	-	-	-	-	-	-	\$994
<b>Optional</b>										
Water	\$723	-	-	-	-	-	-	-	-	\$723
Sewer Only	\$245	-	-	-	-	-	-	-	-	\$245
<b>Excess</b>										
Regular	-	\$31	\$3	-	-	-	-	-	-	\$33
Optional	-	\$366	\$314	-	-	-	-	-	-	\$681
Sewer Only-Regular	-	\$20	\$28	-	-	-	-	-	-	\$48
Sewer Only-Optional	-	\$164	\$125	-	-	-	-	-	-	\$289
<b>Industrial</b>										
<b>Regular</b>										
Water	\$229	\$74	\$72	\$1,942	\$40	\$34	\$75	\$2,179	\$865	\$5,510
Sewer Only	\$317	\$103	\$99	-	-	-	-	-	-	\$519



**Table 1.6-28. Revenue Requirements Before Reallocation of Infiltration/Inflow (Thousands of Dollars) FY2014**

	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage Stormwater	Flood Protection	Total
<b>Optional</b>										
Water	\$1,338	-	-	-	-	-	-	-	-	\$1,338
Sewer Only	\$2,156	-	-	-	-	-	-	-	-	\$2,156
<b>Excess</b>										
Regular	-	\$19	\$28	-	-	-	-	-	-	\$48
Optional	-	\$773	\$696	-	-	-	-	-	-	\$1,469
Sewer Only-Regular	-	\$208	\$50	-	-	-	-	-	-	\$258
Sewer Only-Optional	-	\$3,346	\$2,881	-	-	-	-	-	-	\$6,227
<b>Metro Government</b>	\$1,145	\$372	\$359	-	\$36	\$22	\$66	\$761	\$270	\$3,030
<b>Infiltration/Inflow</b>	\$20,956	\$2,552	\$4,456	-	-	-	-	-	-	\$27,964
<b>Total</b>	<b>\$53,041</b>	<b>\$16,448</b>	<b>\$17,246</b>	<b>\$1,942</b>	<b>\$22,281</b>	<b>\$13,309</b>	<b>\$41,157</b>	<b>\$34,621</b>	<b>\$13,371</b>	<b>\$213,416</b>



**Table 1.6-29. Revenue Requirements After Reallocation of Infiltration/Inflow (Thousands of Dollars) FY2014**

Customer Class Units of Service	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage-Stormwater	Flood Protection	Total
<b>Residential</b>										
<b>Regular</b>										
Water	\$17,263	\$4,443	\$4,293	-	\$20,325	\$12,123	\$37,543	\$18,996	\$4,475	\$119,460
Sewer Only	\$0.12	\$0.03	\$0.03	-	-	-	-	-	-	\$0.18
<b>Commercial</b>										
<b>Regular</b>										
Water	\$14,684	\$3,779	\$3,652	-	\$1,880	\$1,130	\$3,473	\$30,597	\$7,762	\$66,956
Sewer Only	\$765	\$197	\$190	-	-	-	-	-	-	\$1,153
<b>Optional</b>										
Water	\$912	-	-	-	-	-	-	-	-	\$912
Sewer Only	\$309	-	-	-	-	-	-	-	-	\$309
<b>Excess</b>										
Regular	-	\$31	\$3	-	-	-	-	-	-	\$33
Optional	-	\$366	\$314	-	-	-	-	-	-	\$681
Sewer Only-Regular	-	\$20	\$28	-	-	-	-	-	-	\$48
Sewer Only-Optional	-	\$164	\$125	-	-	-	-	-	-	\$289
<b>Industrial</b>										
<b>Regular</b>										
Water	\$288	\$74	\$72	\$1,942	\$40	\$34	\$75	\$3,411	\$865	\$6,802
Sewer Only	\$400	\$103	\$99	-	-	-	-	-	-	\$602



**Table 1.6-29. Revenue Requirements After Reallocation of Infiltration/Inflow (Thousands of Dollars) FY2014**

Customer Class Units of Service	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage-Stormwater	Flood Protection	Total
<b>Optional</b>										
Water	\$1,688	-	-	-	-	-	-	-	-	\$1,688
Sewer Only	\$2,720	-	-	-	-	-	-	-	-	\$2,720
<b>Excess</b>										
Regular	-	\$19	\$28	-	-	-	-	-	-	\$48
Optional	-	\$773	\$696	-	-	-	-	-	-	\$1,469
Sewer Only-Regular	-	\$208	\$50	-	-	-	-	-	-	\$258
Sewer Only-Optional	-	\$3,346	\$2,881	-	-	-	-	-	-	\$6,227
<b>Metro Government</b>	\$1,444	\$372	\$359	-	\$36	\$22	\$66	\$1,191	\$270	\$3,760
<b>Total</b>	<b>\$40,474</b>	<b>\$13,896</b>	<b>\$12,790</b>	<b>\$1,942</b>	<b>\$22,281</b>	<b>\$13,309</b>	<b>\$41,157</b>	<b>\$54,196</b>	<b>\$13,371</b>	<b>\$213,416</b>



**Table 1.6-30. Revenue Requirements After Reallocation of Consent Decree Costs (Thousands of Dollars) FY2014**

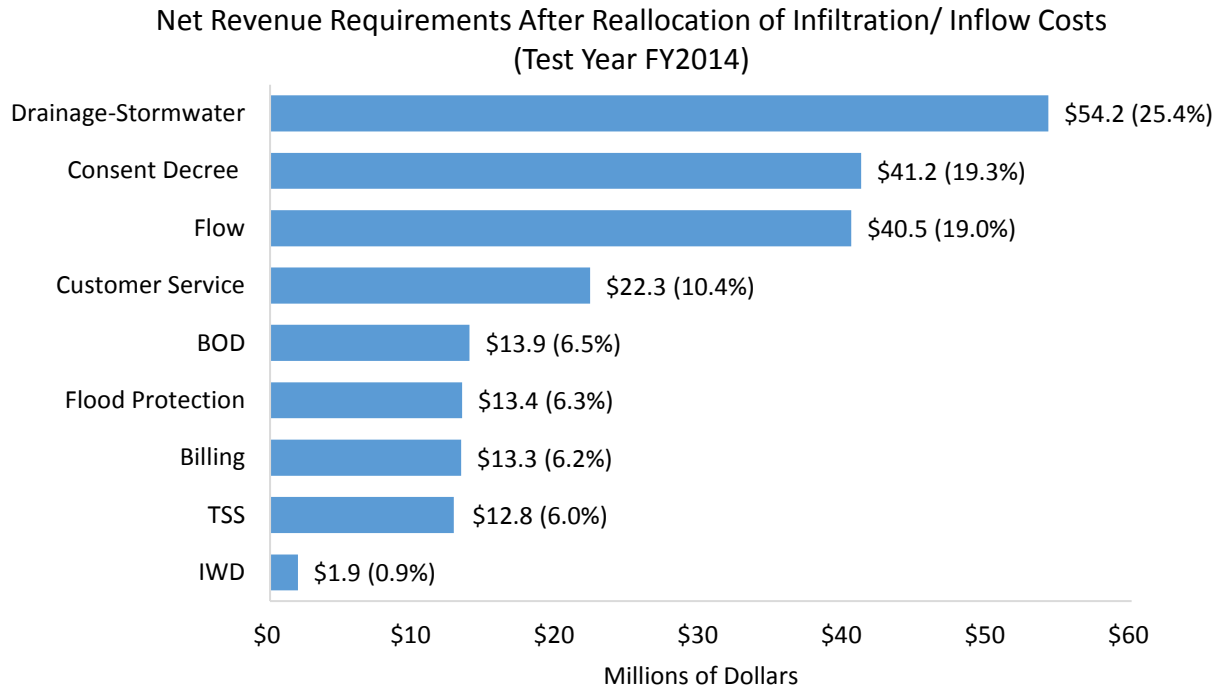
Customer Class Units of Service	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage-Stormwater	Flood Protection	Total
<b>Residential</b>										
<b>Regular</b>										
Water	\$17,263	\$4,443	\$4,293	-	\$20,325	\$12,123	\$23,716	\$18,996	\$4,475	\$105,633
Sewer Only	\$0.12	\$0.03	\$0.03	-	-	-	\$0.09	-	-	\$0.27
<b>Commercial</b>										
<b>Regular</b>										
Water	\$14,684	\$3,779	\$3,652	-	\$1,880	\$1,130	\$12,285	\$30,597	\$7,762	\$75,768
Sewer Only	\$765	\$197	\$190	-	-	-	\$590	-	-	\$1,743
<b>Optional</b>										
Water	\$912	-	-	-	-	-	\$467	-	-	\$1,379
Sewer Only	\$309	-	-	-	-	-	\$158	-	-	\$468
<b>Excess</b>										
Regular	-	\$31	\$3	-	-	-	-	-	-	\$33
Optional	-	\$366	\$314	-	-	-	-	-	-	\$681
Sewer Only-Regular	-	\$20	\$28	-	-	-	-	-	-	\$48
Sewer Only-Optional	-	\$164	\$125	-	-	-	-	-	-	\$289
<b>Industrial</b>										
<b>Regular</b>										
Water	\$288	\$74	\$72	\$1,942	\$40	\$34	\$243	\$3,411	\$865	\$6,971
Sewer Only	\$400	\$103	\$99	-	-	-	\$308	-	-	\$910



**Table 1.6-30. Revenue Requirements After Reallocation of Consent Decree Costs (Thousands of Dollars) FY2014**

Customer Class Units of Service	Flow	BOD	TSS	IWD	Customer Service	Billing	Consent Decree	Drainage-Stormwater	Flood Protection	Total
<b>Optional</b>	-	-	-	-	-	-	-	-	-	-
Water	\$1,688	-	-	-	-	-	\$864	-	-	\$2,552
Sewer Only	\$2,720	-	-	-	-	-	\$1,393	-	-	\$4,113
<b>Excess</b>	-	-	-	-	-	-	-	-	-	-
Regular	-	\$19	\$28	-	-	-	-	-	-	\$48
Optional	-	\$773	\$696	-	-	-	-	-	-	\$1,469
Sewer Only-Regular	-	\$208	\$50	-	-	-	-	-	-	\$258
Sewer Only-Optional	-	\$3,346	\$2,881	-	-	-	-	-	-	\$6,227
<b>Metro Government</b>	\$1,444	\$372	\$359	-	\$36	\$22	\$1,132	\$1,191	\$270	\$4,826
<b>Total</b>	<b>\$40,474</b>	<b>\$13,896</b>	<b>\$12,790</b>	<b>\$1,942</b>	<b>\$22,281</b>	<b>\$13,309</b>	<b>\$41,157</b>	<b>\$54,196</b>	<b>\$13,371</b>	<b>\$213,416</b>

Figure 1.6-11 summarizes the net revenue requirements after reallocation of costs by cost component. Drainage costs represent the largest share of costs, which is attributed to the reallocation of infiltration costs. The second largest cost component is Consent Decree, which is attributed to the EPA Consent Decree.



**Figure 1.6-11. Net Revenue Requirements After Reallocation of Costs (Test Year = FY2014)**

## 6.11 DEVELOPMENT OF COST SERVICE RATES

This section summarizes the development of Cost of Service rates. Section 6.3 presented the FY2014 existing rate structure, which is organized by rate component and customer type and is the starting point for developing Cost of Service rates. Note that MSD rate components are part of the overall rate structure. An increase or decrease in any individual rate component may be caused by a change in cost center structure, a change in actual cost trends incurred per cost center, or a change in how costs are allocated to each cost center. It is not appropriate to draw any conclusions based on an increase or decrease in an individual rate component.

### 6.11.1 Service Charge

The monthly and bimonthly service charge is based on a customer’s connection size. The service charge is determined based on EQM ratio relative to a 5/8-inch meter. The EQM ratio is based on the schedule of service charges in effect as of August 1, 2013 (FY2014). For example, the EQM ratio for a 1-inch meter is 1.744, which means the monthly/bimonthly service charge is 1.744 of the charge for a 5/8-inch meter.



Table 1.6-31 summarizes the number of EQMs by customer type, which are used to develop the service charge based on the Cost of Service for IWD, customer service, and billing presented in Section 6.9. Table 1.6-32 summarizes the development of service charge (\$ per 5/8-inch connection) by customer type and billing cycle (monthly/bimonthly). Table 1.6-33 summarizes the schedule of service charges based on the Cost of Service.

**Table 1.6-31. Equivalent Meters by Customer Type FY2014**

Customer Type/ Connection Size (inches)	EQM Ratios	Monthly		Bimonthly	
		Connections	EQM	Connections	EQM
<b>Residential</b>					
5/8	1.000	5,160	5,160	85,614	85,614
5/8 or 3/4	1.000	6,447	6,447	106,980	106,980
3/4	1.000	268	268	4,452	4,452
1	1.744	111	194	1,846	3,219
1-1/2	2.616	6	16	96	251
2	3.359	2	7	29	97
<b>Total Residential</b>		<b>11,994</b>	<b>12,091</b>	<b>199,017</b>	<b>200,614</b>
<b>Commercial</b>					
5/8	1.000	243	243	3,513	3,513
5/8 or 3/4	1.000	368	368	5,325	5,325
3/4	1.000	60	60	868	868
1	1.744	284	495	4,101	7,152
1-1/2	2.616	130	340	1,877	4,910
2	3.359	127	427	1,838	6,174
3	7.106	30	213	438	3,112
4	11.197	15	168	220	2,463
6	21.515	5	108	70	1,506
8	32.337	0	0	6	194
10	42.285	0	0	0	0
<b>Total Commercial</b>		<b>1,262</b>	<b>2,422</b>	<b>18,256</b>	<b>35,218</b>
<b>Industrial</b>					
5/8	1.000	20	20	20	20
5/8 or 3/4	1.000	25	25	25	25
3/4	1.000	7	7	7	7
1	1.744	35	61	35	61
1-1/2	2.616	28	73	27	71
2	3.359	38	128	38	128



**Table 1.6-31. Equivalent Meters by Customer Type FY2014**

Customer Type/ Connection Size (inches)	EQM Ratios	Monthly		Bimonthly	
		Connections	EQM	Connections	EQM
3	7.106	15	107	15	107
4	11.197	21	235	21	235
6	21.515	16	344	16	344
8	32.337	5	162	5	162
10	42.285	1	42	0	0
<b>Total Industrial</b>		<b>211</b>	<b>1,204</b>	<b>209</b>	<b>1,159</b>
<b>Metro Government</b>					
5/8	1.000	2	2	17	17
5/8 or 3/4	1.000	1	1	51	51
3/4	1.000	0	0	12	12
1	1.744	0	0	69	120
1-1/2	2.616	5	13	70	183
2	3.359	6	20	78	262
3	7.106	12	85	19	135
4	11.197	2	22	13	146
6	21.515	8	172	6	129
8	32.337	1	32	0	0
10	42.285	0	0	0	0
<b>Total</b>		<b>37</b>	<b>348</b>	<b>335</b>	<b>1,055</b>

**Table 1.6-32. Development of Service Charge per Equivalent Meter FY2014**

	EQM	Allocation Percentage	Allocated Customer and Billing Costs	\$ per 5/8-inch connection
<b>Residential</b>	212,705		<b>\$32,447,454</b>	
Monthly	12,091	5.68%	\$1,844,443	\$12.71
Bimonthly	200,614	94.32%	\$30,603,011	\$25.42
<b>Commercial</b>	37,640		<b>\$3,009,604</b>	
Monthly	2,422	6.43%	\$193,633	\$6.66
Bimonthly	35,218	93.57%	\$2,815,971	\$13.33
<b>Industrial</b>	2,363		<b>\$58,065</b>	
Monthly	1,204	50.95%	\$43,653	\$3.45
Bimonthly	1,159	49.05%	\$15,390	\$6.90



**Table 1.6-32. Development of Service Charge per Equivalent Meter FY2014**

	EQM	Allocation Percentage	Allocated Customer and Billing Costs	\$ per 5/8-inch connection
<b>Metro Government</b>	1,403		<b>\$2,016,701</b>	
Monthly	1,055	75.18%	\$1,027,512	\$71.13
Bimonthly	372	26.51%	\$989,189	\$142.25
<b>Total</b>	<b>254,111</b>		<b>\$37,531,824</b>	<b>\$147.70</b>
Monthly	16,772	6.60%	2,477,151	\$12.31
Bimonthly	237,363	93.41%	35,058,166	\$24.62

**Table 1.6-33. Schedule of Service Charges FY2014**

Connection Size (inches)	EQM Ratio	Residential		Commercial		Industrial		Metro Government	
		Monthly	Bimonthly	Monthly	Bimonthly	Monthly	Bimonthly	Monthly	Bimonthly
5/8	1.000	\$12.71	\$25.42	\$6.66	\$13.33	\$71.13	\$142.25	\$3.45	\$6.90
3/4	1.000	\$12.71	\$25.42	\$6.66	\$13.33	\$71.13	\$142.25	\$3.45	\$6.90
1	1.744	\$22.17	\$44.33	\$11.62	\$23.25	\$124.05	\$248.08	\$6.02	\$12.03
1-1/2	2.616	\$33.25	\$66.50	\$17.42	\$34.87	\$186.08	\$372.13	\$9.03	\$18.05
2	3.359	\$42.69	\$85.39	\$22.37	\$44.78	\$238.93	\$477.82	\$11.59	\$23.18
3	7.106	\$90.32	\$180.63	\$47.33	\$94.72	\$505.45	\$1,010.83	\$24.52	\$49.03
4	11.197	\$142.31	\$284.63	\$74.57	\$149.26	\$796.44	\$1,592.77	\$38.63	\$77.26
6	21.515	\$273.46	\$546.91	\$143.29	\$286.79	\$1,530.36	\$3,060.51	\$74.23	\$148.45
8	32.337	\$411.00	\$822.01	\$215.36	\$431.05	\$2,300.13	\$4,599.94	\$111.56	\$223.13
10	42.285	\$537.44	\$1,074.88	\$281.62	\$563.66	\$3,007.73	\$6,015.04	\$145.88	\$291.77

### 6.11.2 Volume Charge

MSD's schedule of volume-based charges including the following: Regular, Optional Clean, and Sewer Only. The volume charges are based the Cost of Service associated with the cost components flow, BOD, and TSS. In addition, portions of these costs are also allocated to the Consent Decree surcharge. The total Cost of Service for flow, BOD, and TSS is approximately \$69.5 million. The FY2014 Consent Decree surcharge revenues were approximately \$39.8 million, which is 59 percent of the Cost of Service for flow, BOD, and TSS. Table 1.6-34 summarizes the breakdown for the Cost of Service related to the volume charges and the Cost of Service rates.



### 6.11.3 Consent Decree Surcharge

To evaluate the Cost of Service rate design for the Consent Decree surcharge, it is assumed that 30 percent of O&M allocated to flow, BOD, TSS, and customer service is attributed to the Consent Decree. In addition, 30 percent of the debt service (for debt series starting in 2009) allocated to flow, BOD, TSS, and customer service is attributed to the Consent Decree. Table 1.6-35 presents the Consent Decree surcharge based on the Cost of Service for the test year. The rate for residential customers is based on per-customer basis, whereas the rate for nonresidential customers is based on volume. Readily available customer data do not delineate the customers who pay based on volume versus customer count.

**Table 1.6-34. Volume Charge Cost of Service Rates FY2014**

Allocated Costs for Flow, BOD, TSS	Volume Charge	Volume (Kgal)	\$/Kgal
<b>Residential Regular</b>	<b>\$25,998,744</b>	<b>11,254,479</b>	<b>\$2.31</b>
Commercial Regular	\$22,114,767	9,573,162	\$2.31
Industrial Regular	\$2,174,894	941,480	\$2.31
Metro Government	\$434,123	187,925	\$2.31
<b>Residential Sewer Only</b>	<b>\$181</b>	<b>78</b>	<b>\$2.31</b>
Commercial Sewer Only	\$1,152,770	499,017	\$2.31
Industrial Sewer Only	\$601,921	260,563	\$2.31
<b>Commercial Optional Regular</b>	<b>\$912,186</b>	<b>594,706</b>	<b>\$1.53</b>
Industrial Optional Regular	\$1,688,078	1,100,554	\$1.53
Optional Commercial Sewer Only	\$309,296	201,647	\$1.53
Optional Industrial Sewer Only	\$2,720,357	1,773,555	\$1.53
<b>Total Allocated Costs for Flow, BOD, TSS</b>	<b>\$58,107,316</b>	<b>26,387,167</b>	<b>\$2.20</b>

**Table 1.6-35. Consent Decree Surcharge Rate Design FY2014**

	Allocated Cost of Service	Units	Unit Measure	Monthly (\$/customer)	Bimonthly (\$/customer)	\$/Kgal
<b>Residential Regular and Sewer Only</b>	<b>\$23,716,396</b>	<b>211,011</b>	<b>customers</b>	<b>\$9.20</b>	<b>\$18.40</b>	
				<b>Greater of \$/customer or \$/Kgal</b>		
<b>Commercial Regular</b>	<b>\$12,284,631</b>	<b>9,573,162</b>	<b>kgal</b>	<b>\$9.20</b>	<b>\$18.40</b>	<b>\$1.27</b>
Metro Government	\$1,131,828	941,480	kgal	\$9.20	\$18.40	\$1.19
Industrial Regular	\$242,970	187,925	kgal	\$9.20	\$18.40	\$1.28
Commercial Sewer Only	\$590,185	499,017	kgal	\$9.20	\$18.40	\$1.17

**Table 1.6-35. Consent Decree Surcharge Rate Design FY2014**

	Allocated Cost of Service	Units	Unit Measure	Monthly (\$/customer)	Bimonthly (\$/customer)	\$/Kgal
Industrial Sewer Only	\$308,166	260,563	kgal	\$9.20	\$18.40	\$1.17
Optional Commercial (Clean)	\$467,013	594,706	kgal	\$9.20	\$18.40	\$0.79
Optional Industrial (Clean)	\$864,248	1,100,554	kgal	\$9.20	\$18.40	\$0.79
Optional Commercial Sewer Only	\$158,351	201,647	kgal	\$9.20	\$18.40	\$0.79
Optional Industrial Sewer Only	\$1,392,745	1,773,555	kgal	\$9.20	\$18.40	\$0.79
<b>Total</b>	<b>\$41,156,535</b>					

#### 6.11.4 Water Quality Surcharges

Water quality surcharges recover the additional treatment costs associated with excess BOD and TSS loadings (that is, loadings above domestic strength wastewater flows). The exception to this is for the optional rate component, which includes loadings for domestic and excess strength wastewater flows. The excess loadings are determined through periodic sampling of wastewater flows to determine the concentrations of BOD and TSS. For wastewater flows with BOD in excess of 250 mg/L, the extra strength loadings are subject to the BOD water quality surcharge. For wastewater flows with TSS in excess of 270 mg/L, the extra strength loadings are subject to the TSS water quality surcharge. Tables 1.6-36 and 1.6-37 present the Cost of Service rates for BOD and TSS, respectively.

**Table 1.6-36. Biochemical Oxygen Demand Water Quality Surcharge Rate Design FY2014**

BOD	Cost of Service	Units	Unit Measure	\$/lbs
<b>Commercial</b>				
<b>Excess</b>				
Regular	\$30,726	162,267	lbs	\$0.189
Optional	\$366,149	1,933,686	lbs	\$0.189
Sewer Only-Regular	\$20,119	106,253	lbs	\$0.189
Sewer Only-Optional	\$163,831	865,215	lbs	\$0.189
<b>Industrial</b>				
<b>Excess</b>				
Regular	\$19,165	101,214	lbs	\$0.189
Optional	\$772,674	4,080,603	lbs	\$0.189
Sewer Only-Regular	\$208,363	1,100,394	lbs	\$0.189
Sewer Only-Optional	\$3,346,407	17,672,855	lbs	\$0.189

**Table 1.6-37. Total Suspended Solids Water Quality Surcharge Rate Design FY2014**

TSS	Cost of Service	Units	Unit Measure	\$/lbs
<b>Commercial</b>				
<b>Excess</b>				
Regular	\$2,599	15,341	lbs	\$0.169
Optional	\$314,402	1,856,075	lbs	\$0.169
Sewer Only-Regular	\$28,329	167,242	lbs	\$0.169
Sewer Only-Optional	\$124,756	736,495	lbs	\$0.169
<b>Industrial</b>				
<b>Excess</b>				
Regular	\$28,376	167,516	lbs	\$0.169
Optional	\$695,850	4,107,950	lbs	\$0.169
Sewer Only-Regular	\$49,815	294,080	lbs	\$0.169
Sewer Only-Optional	\$2,881,093	17,008,538	lbs	\$0.169

### 6.12 COMPARISON OF RATES EFFECTIVE AUGUST 1, 2013 AND COST OF SERVICE RATES

This section presents the comparison of rates that were effective August 1, 2013 and Cost of Service rates for the FY2014 test year. There are some notable differences, which are described for each rate component. For the service charge, the monthly rate for residential customers decreased, while the bimonthly rate increased slightly. The monthly and bimonthly rates decreased for commercial and Metro Government customers. The monthly and bimonthly rates increased significantly for industrial customers. This comparison suggests a cross subsidization among customer groups for the rates effective August 1, 2013. Table 1.6-38 presents the Cost of Service rates for the service charge. The Cost of Service rates by customer class represents the number of customers, EQMs, and number of bills. The following are options to consider:

- Maintain existing rate structure.
- Adopt Cost of Service rate schedule by customer class.
- Adopt Cost of Service rate schedule for residential and combine government, industrial, and Metro Government customer classes.
- Combine all customer classes and implement a rate schedule that applies to all customer classes.

There are advantages and disadvantages to each option. To address the goal and objective of Cost of Service, the options that introduce cross subsidization among customer classes would not be acceptable. If some degree of subsidization is acceptable because it would address other goals and



objectives, then the option that combines all customer classes and implements a rate schedule that applies to all customer classes could be a reasonable compromise.

**Table 1.6-38. Comparison of Service Charges FY2014**

Service Charges by Customer Class by Connection Size (inches)	Monthly Bill Cycle		Bimonthly Bill Cycle	
	Rate Effective August 1, 2013	FY2014 Cost of Service	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Residential</b>				
5/8	\$17.78	\$12.71	\$23.17	\$25.42
5/8 or 3/4	\$17.78	\$12.71	\$23.17	\$25.42
3/4	\$17.78	\$12.71	\$23.17	\$25.42
1	\$31.00	\$22.17	\$46.52	\$44.33
1-1/2	\$46.52	\$33.25	\$77.40	\$66.50
2	\$59.73	\$42.69	\$106.15	\$85.39
3	\$126.35	\$90.32	\$236.64	\$180.63
4	\$199.09	\$142.31	\$382.62	\$284.63
6	\$382.54	\$273.46	\$751.83	\$546.91
8	\$574.96	\$411.00	\$1,127.76	\$822.01
10	\$751.83	\$537.44	\$1,481.61	\$1,074.88
<b>Commercial Charges</b>				
5/8	\$17.78	\$6.66	\$23.17	\$13.33
5/8 or 3/4	\$17.78	\$6.66	\$23.17	\$13.33
3/4	\$17.78	\$6.66	\$23.17	\$13.33
1	\$31.00	\$11.62	\$46.52	\$23.25
1-1/2	\$46.52	\$17.42	\$77.40	\$34.87
2	\$59.73	\$22.37	\$106.15	\$44.78
3	\$126.35	\$47.33	\$236.64	\$94.72
4	\$199.09	\$74.57	\$382.62	\$149.26
6	\$382.54	\$143.29	\$751.83	\$286.79
8	\$574.96	\$215.36	\$1,127.76	\$431.05
10	\$751.83	\$281.62	\$1,481.61	\$563.66
<b>Industrial Charges</b>				
5/8	\$17.78	\$71.13	\$23.17	\$142.25
5/8 or 3/4	\$17.78	\$71.13	\$23.17	\$142.25
3/4	\$17.78	\$71.13	\$23.17	\$142.25



**Table 1.6-38. Comparison of Service Charges FY2014**

Service Charges by Customer Class by Connection Size (inches)	Monthly Bill Cycle		Bimonthly Bill Cycle	
	Rate Effective August 1, 2013	FY2014 Cost of Service	Rate Effective August 1, 2013	FY2014 Cost of Service
1	\$17.78	\$124.05	\$46.52	\$248.08
1-1/2	\$31.00	\$186.08	\$77.40	\$372.13
2	\$46.52	\$238.93	\$106.15	\$477.82
3	\$59.73	\$505.45	\$236.64	\$1,010.83
4	\$126.35	\$796.44	\$382.62	\$1,592.77
6	\$199.09	\$1,530.36	\$751.83	\$3,060.51
8	\$382.54	\$2,300.13	\$1,127.76	\$4,599.94
10	\$574.96	\$3,007.73	\$1,481.61	\$6,015.04
<b>Metro Government</b>				
5/8	\$17.78	\$3.45	\$23.17	\$6.90
5/8 or 3/4	\$17.78	\$3.45	\$23.17	\$6.90
3/4	\$17.78	\$3.45	\$23.17	\$6.90
1	\$31.00	\$6.02	\$46.52	\$12.03
1-1/2	\$46.52	\$9.03	\$77.40	\$18.05
2	\$59.73	\$11.59	\$106.15	\$23.18
3	\$126.35	\$24.52	\$236.64	\$49.03
4	\$199.09	\$38.63	\$382.62	\$77.26
6	\$382.54	\$74.23	\$751.83	\$148.45
8	\$574.96	\$111.56	\$1,127.76	\$223.13
10	\$751.83	\$145.88	\$1,481.61	\$291.77

Note: Rates Effective August 1, 2013 versus FY2014 Cost of Service.

For the volume charge (Table 1.6-39), the regular, optional (clean), and sewer only rates decreased. One explanation could be related to the discount applied to billed water consumption to account for water not entering the sewer system. However, the Cost of Service rates were developed based on billed sewer flows and account for any discounts associated with billed water. The decrease is most likely attributed to a change in allocation of costs from flow to Consent Decree, drainage-stormwater, and/or flood protection. The following are options to consider:

- Maintain existing rate structure.
- Implement Cost of Service rates.
- Adopt a uniform rate that applies to all customers.



The advantage of a uniform volume rate is that it simplifies the rate schedule. The disadvantage would be the elimination of the optional and sewer-only rate categories, which were implemented to address special conditions that are not appropriately considered in uniform volume rate approaches (for example, highly dilute wastewater that has a lower cost to treat, drainage customers that have private wastewater disposal systems).

**Table 1.6-39. Comparison of Volume Charges**

Wastewater Volume Charges	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Regular Volume Rate (\$/1,000 gallons)</b>		
Residential	\$3.17	\$2.31
Commercial	\$3.66	\$2.31
Industrial	\$3.81	\$2.31
<b>Optional (Clean) Volume Rate</b>		
Commercial Optional Regular	\$2.16	\$1.53
Industrial Optional Regular	\$2.16	\$1.53
Sewer Only - Commercial	\$2.32	\$1.53
Sewer Only - Industrial	\$2.32	\$1.53
<b>Sewer Only Volume Rate</b>		
Residential	\$3.65	\$2.31
Commercial	\$4.09	\$2.31
Industrial	\$4.11	\$2.31

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

The comparison Consent Decree rates are mostly consistent when comparing the Cost of Service schedule (Table 1.6-40) and the rates effective August 1, 2013. There are small increases or decreases for some rate categories. The small difference could be attributed to change in the Cost of Service since the rate structure was implemented in 2009. Residential customers pay a fixed amount per bill; nonresidential customers pay the greater of the fixed amount for a residential customer or the amount based on \$/Kgal. The Cost of Service analysis assumed that all nonresidential customers pay based on \$/Kgal, as data that delineate the number of nonresidential customers who pay the fixed amount versus \$/Kgal were not readily available. The following are options to consider:

- Maintain existing rate structure.
- Implement Cost of Service rates.
- Adopt a uniform rate that applies to all customers. The rate could be expressed as either “per customer” or “per EQM.”



The advantage of uniform rate is the simplicity of the rate schedule. If a uniform rate applied to all customers, the many rate categories would not be needed. This would help in future Cost of Service studies and would simplify the data requirements.

**Table 1.6-40. Comparison of Consent Decree Surcharges**

Customer Class	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
Residential (monthly)	\$/bill	\$9.46	\$9.20
Residential (bimonthly)	\$/bill	\$18.92	\$18.40
Condominium without water meters	\$/Kgal	\$1.58	\$1.27
Commercial Regular	\$/Kgal	\$1.13	\$1.28
Metro Government	\$/Kgal	\$1.13	\$1.17
Industrial Regular	\$/Kgal	\$1.18	\$1.28
Commercial Sewer Only	\$/Kgal	\$1.26	\$1.17
Industrial Sewer Only	\$/Kgal	\$1.26	\$0.79
Optional Commercial (Clean)	\$/Kgal	\$0.67	\$0.79
Optional Industrial (Clean)	\$/Kgal	\$0.67	\$0.79
Optional Commercial Sewer Only	\$/Kgal	\$0.72	\$0.79
Optional Industrial Sewer Only	\$/Kgal	\$0.72	\$1.27

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

There is a decrease in BOD water quality surcharge rates (Table 1.6-41) and a slight increase in TSS water quality surcharge rates (Table 1.6-42) when comparing the rates effective August 1, 2013 and the Cost of Service rates. This is mostly likely because of shifts in costs from BOD and TSS to the Consent Decree and/or reallocation of I/I costs to drainage-stormwater. The following are options to consider:

- Maintain existing rate structure.
- Implement Cost of Service rates.

**Table 1.6-41. Comparison of Biochemical Oxygen Demand Water Quality Surcharges**

Customer Class and Rate Component	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Commercial</b>			
Regular	\$/lbs	\$0.3616	\$0.1880
Optional	\$/lbs	\$0.3616	\$0.1880
Sewer Only-Regular	\$/lbs	\$0.3616	\$0.1880
Sewer Only-Optional	\$/lbs	\$0.3616	\$0.1880
<b>Industrial</b>			
Regular	\$/lbs	\$0.3616	\$0.1880



**Table 1.6-41. Comparison of Biochemical Oxygen Demand Water Quality Surcharges**

Customer Class and Rate Component	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
Optional	\$/lbs	\$0.3616	\$0.1880
Sewer Only-Regular	\$/lbs	\$0.3616	\$0.1880
Sewer Only-Optional	\$/lbs	\$0.3616	\$0.1880

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

**Table 1.6-42. Comparison of Total Suspended Solids Water Quality Surcharges**

Customer Class and Rate Component	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Commercial</b>			
Regular	\$/lbs	\$0.1491	\$0.1680
Optional	\$/lbs	\$0.1491	\$0.1680
Sewer Only-Regular	\$/lbs	\$0.1491	\$0.1680
Sewer Only-Optional	\$/lbs	\$0.1491	\$0.1680
<b>Industrial</b>			
Regular	\$/lbs	\$0.1491	\$0.1680
Optional	\$/lbs	\$0.1491	\$0.1680
Sewer Only-Regular	\$/lbs	\$0.1491	\$0.1680
Sewer Only-Optional	\$/lbs	\$0.1491	\$0.1680

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

As part of this Cost of Service, the study documents the addition of the flood protection charge. This charge is added to address the Cost of Service for flood protection. The flood protection charge (Table 1.6-43) would apply to all customers, including those who do not receive drainage services, but still benefit from the protection provided to the entire community. The Cost of Service rate for the flood protection charge was determined based on the cost centers maintained by MSD related to flood protection.

For the drainage-stormwater charge (Table 1.6-43), there is slight increase in the rate when comparing the rates effective August 1, 2013 and the Cost of Service rates. This is most likely attributed to an increase in cost associated with the reallocation of I/I to the drainage-stormwater cost component. The Cost of Service analysis assumes that 70 percent of the I/I costs relate to infiltration and are allocated to the Drainage-Stormwater cost component. The following are options to consider:

- Maintain existing rate structure (Table 1.6-44).



- Implement Cost of Service rates with the addition of the flood protection charge.

The advantage of implementing the flood protection charge is that it recognizes the cost associated with flood protection and establishes a rate that all customers pay and receive benefits of flood protection efforts of MSD.

**Table 1.6-43. Comparison of Drainage-Stormwater and Proposed Flood Protection Charges**

	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Drainage-Stormwater</b>			
Class A -- Residential	\$/ESU	\$7.28	\$7.77
Class B -- Commercial	\$/ESU	\$7.28	\$7.77
Class B -- Metro Government	\$/ESU	\$7.28	\$7.77
Class B -- Industrial	\$/ESU	\$7.28	\$7.77
<b>Flood Protection</b>			
Drainage			
Residential	\$/ESU	n/a	\$1.76
Commercial	\$/ESU	n/a	\$1.76
Metro Government	\$/ESU	n/a	\$1.76
Industrial	\$/ESU	n/a	\$1.76
Nondrainage			
Residential	\$/ESU	n/a	\$1.76
Commercial			\$1.76
Industrial	\$/ESU	n/a	\$1.76

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

**Table 1.6-44. Drainage-Stormwater Charge without Proposed Flood Protection Charges**

	Unit Measure	Rate Effective August 1, 2013	FY2014 Cost of Service
<b>Drainage-Stormwater</b>			
Class A -- Residential	\$/ESU	\$7.28	\$9.68
Class B -- Commercial	\$/ESU	\$7.28	\$9.68
Class B -- Metro Government	\$/ESU	\$7.28	\$9.68
Class B -- Industrial	\$/ESU	\$7.28	\$9.68

Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.



### 6.13 BILL IMPACT

The bill impact analysis focuses on a typical residential bill, which assumes the following: a bimonthly bill or 10,000 gallons of water (adjusted to 8,500 gallons of billed sewer flows), with a 5/8-inch connection. Table 1.6-45 presents the typical residential bill based on rates effective August 1, 2013, and Cost of Service rates. While there are differences among the individual rate components, the totals for sewer and stormwater are very similar.

**Table 1.6-45. Comparison of Typical Residential Bill FY2014**

	Rates Effective August 1, 2013	Estimated Bimonthly Bill	Estimated Annual Bill	Cost of Service Rates	Estimated Bimonthly Bill	Estimated Annual Bill
<b>Sewer Rate Component</b>						
Service Charge	\$23.17	\$23.17	\$139.02	\$25.42	\$25.42	\$152.52
Volume Charge	\$3.17	\$26.95	\$161.67	\$2.31	\$19.64	\$117.81
Consent Decree Surcharge	\$18.92	\$18.92	\$113.52	\$18.74	\$18.74	\$112.44
<b>Total Sewer</b>		<b>\$69.04</b>	<b>\$414.21</b>		<b>\$63.80</b>	<b>\$382.77</b>
<b>Drainage-Stormwater Charge</b>	\$14.56	\$14.56	\$87.36	\$18.74	\$18.74	\$112.44
<b>Flood Protection Charge</b>	\$0.00	\$0.00	\$0.00	\$3.52	\$3.52	\$21.12
<b>Total Typical Residential Bill</b>		<b>\$83.60</b>	<b>\$501.57</b>		<b>\$86.06</b>	<b>\$516.33</b>

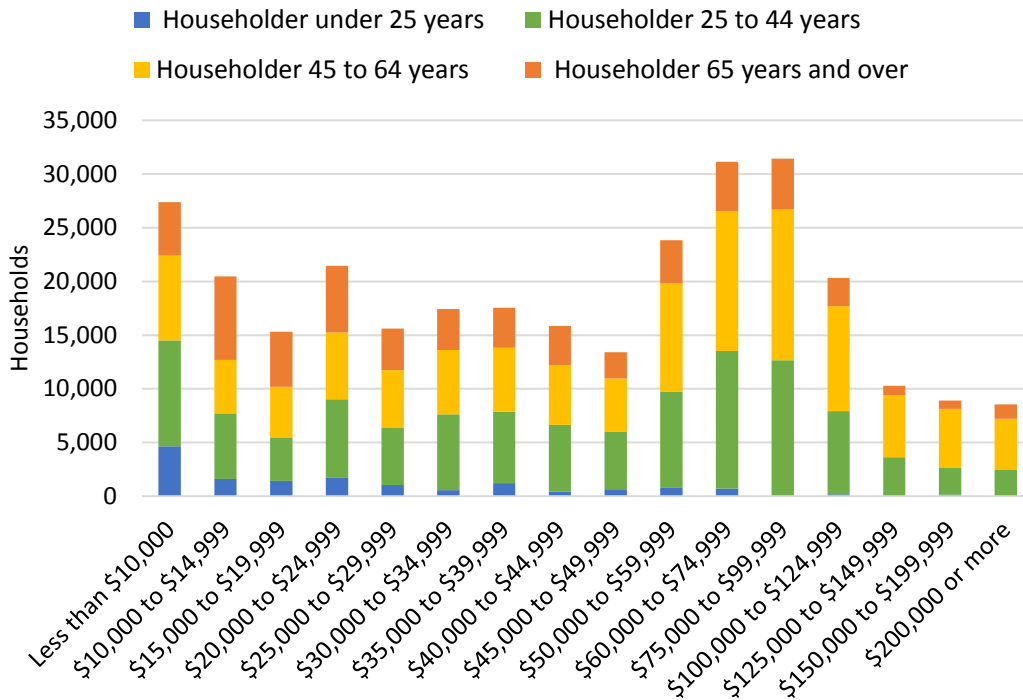
Note: Rates effective August 1, 2013 versus FY2014 Cost of Service.

### 6.14 AFFORDABILITY

A general measure of affordability is the typical residential bill as a percentage of Median Household Income (MHI). Based on U.S. Census data and the typical bill calculation presented in Section 6.12, a simple affordability analysis is presented in this section.

#### 6.14.1 Income Distribution

MHI is a narrow measure and only provides an indicator of affordability for a small portion of households. To understand the affordability of a typical sewer and drainage bill, the income distribution provides a broader spectrum of affordability. Figure 1.6-12 presents the number of households by income category and age of householder.



**Figure 1.6-12. Income Distribution by Age of Householder**

**6.14.2 Typical Residential Bill as Percent of Median Household Income**

Table 1.6-46 presents the MHI for all households and by age of householder. Typical residential bill as percent of MHI is less than the 2 percent affordability threshold except for householders age 15 to 24.

**Table 1.6-46. Median Household Income by Age of Householder**

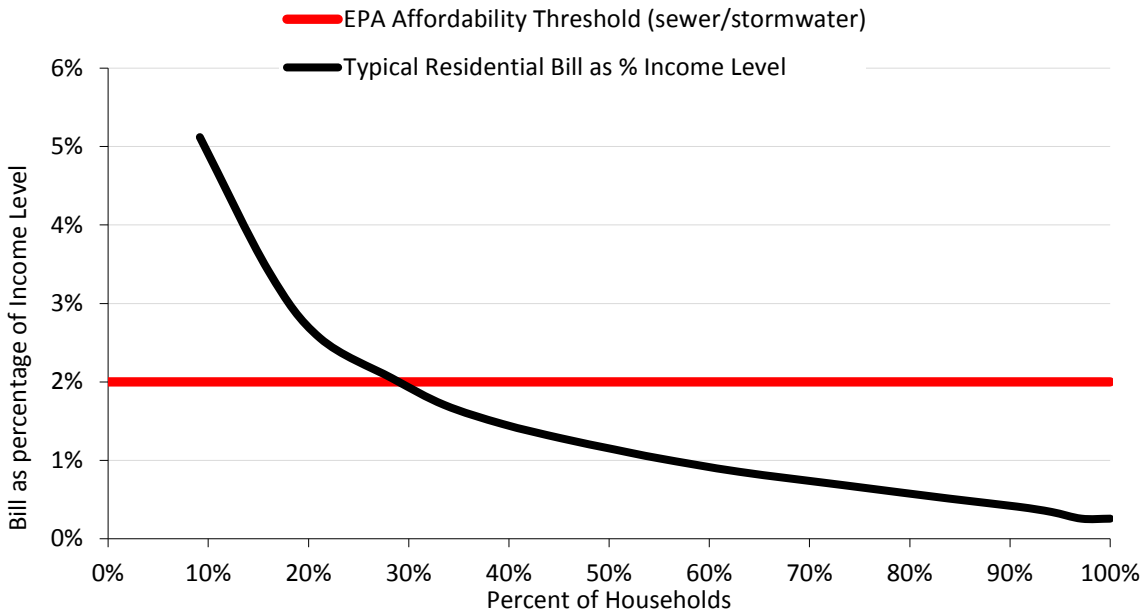
Median Household Income by Age of Householder	Estimate 2009 Dollars <sup>a</sup>	Margin of Error	Estimate 2014 Dollars	Typical Residential Sewer/Drainage Bill based on COS Rates	Sewer/Drainage Bill as % of MHI
<b>All Households</b>	<b>44,437</b>	<b>+/-1,425</b>	<b>\$49,035</b>	<b>\$516</b>	<b>1.05%</b>
15 to 24 years	19,936	+/-3,786	\$21,999	\$516	2.35%
25 to 44 years	46,912	+/-2,750	\$51,766	\$516	1.00%
45 to 64 years	55,834	+/-2,674	\$61,611	\$516	0.84%
65 years and over	33,230	+/-1,569	\$36,668	\$516	1.41%

<sup>a</sup>Source: U.S. Census Bureau (2009).

Table 1.6-47 and Figure 1.6-13 present a typical residential bill as percent of MHI by income bracket, which provides a better understanding regarding the portion of households in which a typical residential bill is considered “high burden.” Approximately 30 percent of households have income less than \$25,000, which is the income level in which the typical residential bill is high burden.

**Table 1.6-47. Typical Residential Bill as Percent of Income Bracket**

<b>Income Bracket</b>	<b>Cumulative Percent of Households</b>	<b>Typical Residential Bill as % Income Bracket</b>
Less than \$10,000	9%	5.2%
\$10,000 to \$14,999	16%	3.4%
\$15,000 to \$19,999	21%	2.6%
\$20,000 to \$24,999	28%	2.1%
\$25,000 to \$29,999	34%	1.7%
\$30,000 to \$34,999	39%	1.5%
\$35,000 to \$39,999	45%	1.3%
\$40,000 to \$44,999	51%	1.1%
\$45,000 to \$49,999	55%	1.0%
\$50,000 to \$59,999	63%	0.9%
\$60,000 to \$74,999	73%	0.7%
\$75,000 to \$99,999	84%	0.5%
\$100,000 to \$124,999	91%	0.4%
\$125,000 to \$149,999	94%	0.3%
\$150,000 to \$199,999	97%	0.3%
\$200,000 or more	100%	0.3%



**Figure 1.6-13. Percent of Households and Bill as Percent of Income Level**

### 6.14.3 Rate Relief Programs

MSD’s current rate relief program is a low-income senior citizen’s discount that offers a 30 percent reduction in rates for senior citizens who have a total income less than \$30,000. MSD currently provides this discount to approximately 9,000 customers, at an annual cost of \$850,000.

In reviewing the potential rate impacts of the Facility Plan recommendations, MSD has recognized that a broader program may be called for to ease the financial burden of utility bills on low-income customers. In reviewing utility rate-relief programs around the country, many utilities are “piggy-backing” on the federal Low-income Home Energy Assistance Program (LiHEAP). The LiHEAP program uses qualification criteria tied to total household income and number of persons in the household. In Louisville Metro, the LiHEAP program is administered by the Department of Community Services.

The Louisville Metro LiHEAP program provides both subsidy and crisis response funding to families with incomes less than 130 percent of the federally defined poverty level for Jefferson County. The qualification levels are published annually in the LiHEAP program application forms. The Louisville Metro LiHEAP program reports between 20,000 to 25,000 clients per year. The program administrators do not have firm figures on the total number of families who would qualify for LiHEAP programs but do not participate in the program for a variety of reasons. Their estimate is that their current clients make up approximately 35 percent of the total number of families who are 130 percent below the poverty level.

MSD staff have discussed the general concept of rate relief with the MSD Board. The MSD Board was generally supportive of rate relief to low-income customers and directed staff to develop a rate relief recommendation for MSD Board consideration.

For illustration purposes, discounts ranging from 20 percent to 40 percent of the bill have been assumed. Actual discounts will be determined by the MSD Board, and are likely to depend in part on the rate increases that are needed to fund the Facility Plan recommendations. With the current LiHEAP participation level, FY2018 funding for a rate relief program would be in the ranges shown in Table 1.6-48.

**Table 1.6-48. Funding Requirements for Rate Relief**

<b>Number of Participating Households</b>	<b>Average Annual Residential MSD Bill FY2018 (projected)<sup>a</sup></b>	<b>Level of Discount</b>	<b>Value of Discount Subsidies</b>
20,000	\$673.57	20%	\$2,694,290
20,000	\$673.57	30%	\$4,041,436
20,000	\$673.57	40%	\$5,388,581
25,000	\$673.57	20%	\$3,367,863
25,000	\$673.57	30%	\$5,051,795
25,000	\$673.57	40%	\$6,735,726

<sup>a</sup> Based on 6.9 percent rate increase in 2017 and projected 20 percent rate increase in FY2018.

Note that the current low-income senior citizen’s discount would overlap with the program but there are likely many people currently receiving low-income senior citizen’s discounts who would not qualify for a rate relief program based on the 130 percent below poverty level criteria. To avoid the loss of this subsidy, it is recommended that anyone who currently participates in the low-income senior citizen’s discount continue to be eligible for the LiHEAP-based program, subject to annual or bi-annual confirmation of eligibility under the current program. This could increase the cost of the program by \$400,000 or more, depending on the level of discount selected by the MSD Board.

## **6.15 RECOMMENDED RATE STRUCTURE**

MSD’s existing rate structure (that is, effective August 15, 2016) was compared to the Cost of Service study results. Changes to allocation factors were recommended, but no basic changes in rate structure are required to align cost of service principles with rates. In this section, other considerations for rate structure changes are discussed, including water quality charges for nitrogen and phosphorus and the development of a flood protection charge. The following sections provide additional discussion of these rate structure elements.

### **6.15.1 Water Quality Charge for Nitrogen and Phosphorus**

MSD’s IWD has evaluated other sources revenues that could be used to recover their costs of operations. An existing primary source is schedule of fees for services provided in support of industrial discharge permits. In addition, water quality charges for BOD and TSS are assessed. One consideration is to develop water quality charges for nitrogen and phosphorus.

While the WQTCs may have permit limits, the two largest plants (Morris Forman and Derek Guthrie) do not remove nitrogen and phosphorus. In addition, the costs associated with nitrogen and phosphorus treatment at MSD's WQTCs are likely minimal. Further, it is estimated that only about 10 percent of MSD's flows receive any nitrogen and phosphorus treatment. If a water quality charge were to be developed for nitrogen and phosphorus, additional data would be needed regarding water quality concentrations from high strength industrial and commercial customers to evaluate water quality charge rates for nitrogen and phosphorus.

It is common for wastewater utilities to assess water quality surcharges for nitrogen and phosphorus in addition to BOD and TSS. Based on a recent survey of Tennessee wastewater utilities conducted by the University of Tennessee (2015), the following bullet items identify the nitrogen and phosphorus surcharge rates and concentrations:

- Athens, Tennessee (TN)— nitrogen (N) more than 30 mg/L and \$1.37 per pound; phosphorus (P) more than 10 mg/L and \$6.87 per pound
- Cleveland, TN—total Kjeldahl nitrogen (TKN) (no minimum) and \$0.1862 per pound per day
- Dickson, TN—ammonia (NH<sub>3</sub>) more than 15 mg/L and \$0.32 per pound
- Jackson, TN—NH<sub>3</sub> more than or equal to 120 mg/L and \$200 per pound
- Lewisburg, TN—NH<sub>3</sub> more than or equal to 45 mg/L and \$0.68 per pound
- Nashville, TN—NH<sub>3</sub> more than 30 mg/L and \$0.4406 per pound
- Paris, TN—NH<sub>3</sub> more than 15 mg/L and \$1.14 per pound

Based on the available data, a water quality charge for nitrogen and phosphorus is not recommended to be implemented; the money to be recovered from water quality charges does not justify the cost of establishing of a new surcharge. Nonetheless, it is recommended that MSD continue to monitor nitrogen and phosphorus levels to identify the appropriate time to develop water quality charges for nitrogen and phosphorus.

### **6.15.2 Flood Protection Charge**

Based on review of the service area for the drainage-stormwater charge, there are customers who are not assessed the drainage charge, but who do receive flood protection charges, as discussed in Section 6.11. Based on the available customer data, there are approximately 12,000 customers in the non-drainage service area, which is estimated to be 57,500 ESUs. The advantage of implementing the flood protection charge is that it recognizes the cost associated with flood protection and establishes a rate that all customers pay to receive the benefits of MSD's flood protection efforts.

The potential flood protection rate was previously identified as \$1.72/ESU per month. A flood protection charge would therefore generate almost \$1.2 million per year from the non-drainage service area. In reviewing the enabling legislation establishing the drainage utility with MSD's General Counsel, it was determined that flood protection is integral to the services provided by the drainage utility. In addition, the memoranda of understanding (MOUs) governing MSD's relationships with the four communities



that are not part of the drainage utility show that MSD may not have the authority to unilaterally impose a fee for flood protection on these communities. Based on this discussion with MSD’s General Counsel, there is no recommendation relative to establishing a separate flood protection fee at this time.

**6.15.3 Wastewater Service Charge**

MSD’s existing rate structure was compared to the Cost of Service study results and there were several differences identified. First, the relationship between monthly and bimonthly charges is different for residential versus commercial/industrial customers. Second, based on the Cost of Service analysis, which followed industry standards (the WEF Manual of Practice), the monthly wastewater service charge is half the bimonthly service charge. The current rate structure (that is, effective August 15, 2016) is not consistent in how it treats residential versus C/I in terms of the service charge. Based on rates effective August 1, 2015, the residential monthly service charge is half the bimonthly. For C/I, the monthly service charge is 75 percent of the bimonthly. Table 1.6-49 presents the wastewater service charges effective August 1, 2016, which illustrates the noted differences. There are no recommendations for changes to the wastewater service charges; however, it is recommended that MSD investigate these differences to document and update the wastewater service charges to be consistent with industry standards or some other basis.

**Table 1.6-49. Wastewater Service Charges Effective August 1, 2016**

<b>Meter Size (inches)</b>	<b>Monthly</b>	<b>Bimonthly</b>	<b>Percent Monthly to Bimonthly</b>
<b>Commercial/Industrial</b>			
5/8	\$21.16	\$27.56	77%
5/8 or 3/4	\$21.16	\$27.56	77%
3/4	\$21.16	\$27.56	77%
1	\$36.89	\$55.35	67%
1-1/2	\$55.35	\$92.09	60%
2	\$71.08	\$126.30	56%
3	\$150.33	\$281.56	53%
4	\$236.88	\$455.24	52%
6	\$455.16	\$894.54	51%
8	\$684.10	\$1,341.84	51%
10	\$894.54	\$1,762.86	51%
12	\$1,298.73	\$2,597.46	50%
15 or 16	\$1,574.23	\$3,148.38	50%
18 or 20	\$2,066.14	\$4,132.28	50%



**Table 1.6-49. Wastewater Service Charges Effective August 1, 2016**

Meter Size (inches)	Monthly	Bimonthly	Percent Monthly to Bimonthly
<b>Residential</b>			
5/8	\$13.78	\$27.56	50%
5/8 or 3/4	\$13.78	\$27.56	50%
3/4	\$13.78	\$27.56	50%
1	\$27.68	\$55.35	50%
1-1/2	\$46.05	\$92.09	50%
2	\$63.15	\$126.30	50%
3	\$140.78	\$281.56	50%
4	\$227.62	\$455.24	50%

## 6.16 FINANCIAL PLAN

This section presents a financial plan for MSD’s continuing operations and CIP. The financial plan builds upon the 2009 IOAP financial plan and incorporates the CIP and operating cost recommendations of the Facility Plan. The following sections summarize the key assumptions, project capital spending, debt service, operating expenditures, and non-operating expenditures.

### 6.16.1 Assumptions

The following is a list of key assumptions used in developing the financial plan:

- In response to a given percentage increase in the wastewater rates, the projected increase in wastewater revenues is assumed to be 85 percent of the proposed rate adjustment, because of price elasticity and customer response to the rising cost of the wastewater bill. That is, if wastewater rates were forecast to increase by 5.0 percent, system wastewater rate revenues would increase by 4.25 percent (5 percent x 0.85). For drainage (stormwater), no elasticity adjustment is assumed, as it is assumed that the amount of impervious area will not change in response to a change in the drainage rates.
- Investment income is forecast to increase by 4 percent per year, over the prior year’s level.
- Build America Bonds (BAB) Refund based on debt service schedule provided by MSD.
- Other operating income (\$4,000,000) and assessments (\$2,000,000) held constant at 2017 budget levels.
- Cost of rate relief program, including the existing senior citizen discount estimated at \$5,000,000 in FY2018 and increases annually proportional to the annual rate increase.

- Base operating expenses are forecast to increase by 3 percent annually beginning with FY2018. Incremental operating increases recommended to address new facilities constructed under the IOAP and the Facility Plan, and recommended “catch up” costs to address the effects of past deferred rehabilitation and renewal are added to the base operating expenses.
- Capitalized overhead expense is estimated as a percent of total operating expenses: 25 percent for FY2017, 25.5 percent FY2018, 22 percent for FY2019, and 20 percent for FY2020 to FY2036.
- Capitalized interest expense is estimated as a percent of total interest expense for existing and projected senior debt obligations: 20 percent from FY2017 to FY2036.
- Debt service payments on forecast new bond issues assumes level debt service, 30-year term at 4.5 percent interest, 1 percent for cost of issuance, and 4 percent for bond reserve.
- Target debt service coverage ratio starting at current coverage budgeted in FY2017, increasing gradually to show a long-term trend to reach 200 percent by the end of the planning period.
- Target ending working capital of 270 days of net operating revenue, with a minimum of 250 days of net operating revenue.
- For FY2017, 15 percent of CIP is equity (cash) funded. Beginning in FY2018, adjust the percentage of CIP equity (cash) funded to achieve target ending working capital.
- Rate increase for FY2018 is 23.0 percent. Beginning in 2019, the percentage increase in wastewater and drainage rates was adjusted to achieve the target debt service coverage ratio beginning in FY2019 with no rate increase exceeding 6.9 percent.

### **6.16.2 Projected Capital Requirements**

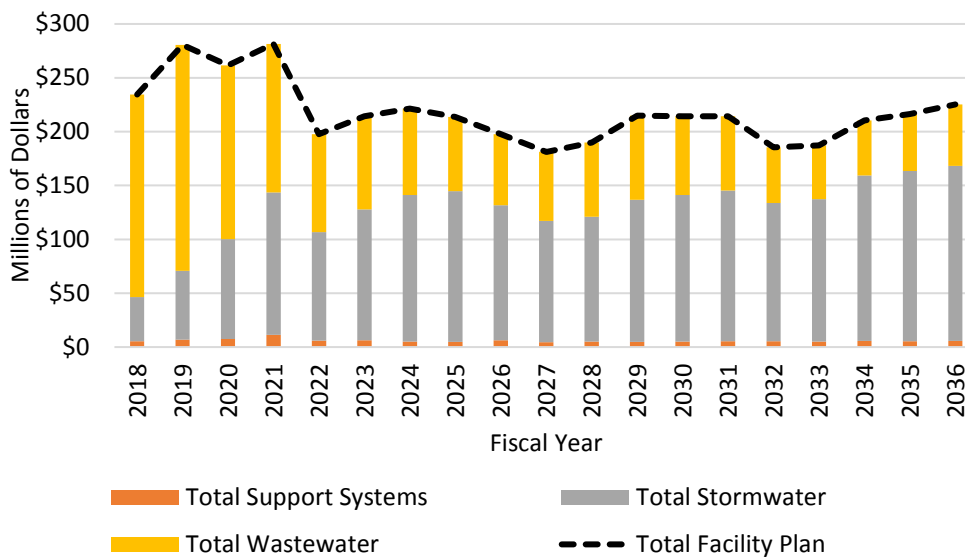
Capital requirements consist of the projected capital expenditures and the funding sources. The capital expenditures are summarized in Table 1.6-50 by 5-year increments, program, and system. In addition, Figure 1.6-14 provides a graphical summary by FY and system. From FY2017 to FY2021, the Consent Decree program drives wastewater capital spending. From FY2022 to FY2036, drainage (stormwater) spending outpaces wastewater capital spending, mostly because of a forecast in drainage program projects and completion of the Consent Decree improvements. Support systems projects account for a small percentage of the total CIP, but are nonetheless critical.

#### **6.16.2.1 Existing Debt Service**

Existing debt service consists of the repayment of senior and subordinate debt obligations as shown on Figure 1.6-15. The most recent bond issuance was in 2016, which consisted of three series. Series 2016A was a new money issue to fund wastewater and drainage capital projects. The proceeds of the Series 2016B and 2016C issues were used to refund previous bond issues.

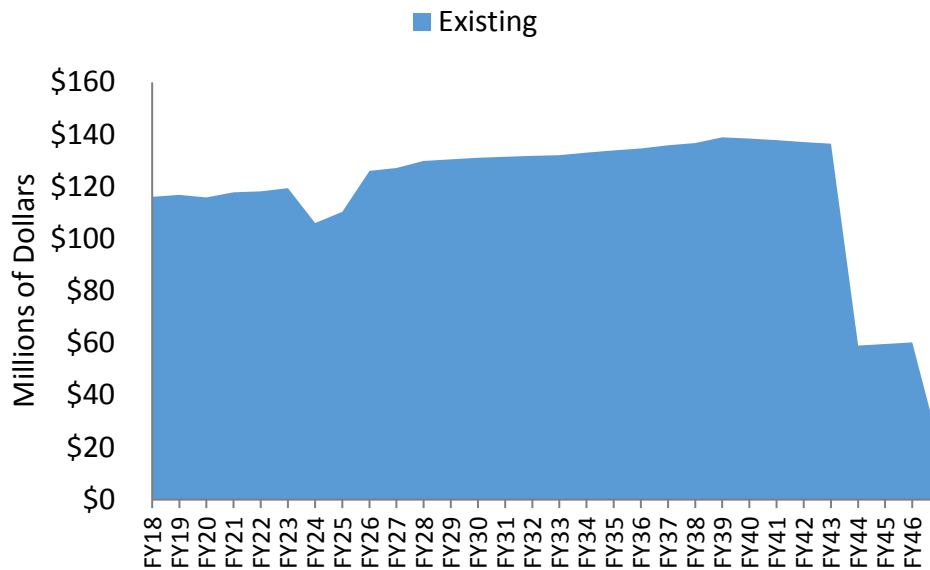
**Table 1.6-50. Facility Plan Capital Improvement Plan Recommendations**

Service Area and Program	Capital Cost (in escalated dollars)				Total FY2017 through FY2036 (millions)
	FY2017 through FY2021 (millions)	FY2022 through FY2026 (millions)	FY2027 through FY2031 (millions)	FY2032 through FY2036 (millions)	
<b>Wastewater</b>	<b>\$848.0</b>	<b>\$392.3</b>	<b>\$353.7</b>	<b>\$262.6</b>	<b>\$1,856.5</b>
Consent Decree (IOAP)	\$564.6	\$26.5	\$ .4	\$ .0	\$591.5
NMC	\$116.2	\$33.2	\$35.1	\$40.0	\$224.5
CMOM	\$144.2	\$275.7	\$184.4	\$201.1	\$805.4
Development	\$23.0	\$56.9	\$133.8	\$21.5	\$235.2
<b>Stormwater</b>	<b>\$348.8</b>	<b>\$623.7</b>	<b>\$636.2</b>	<b>\$734.7</b>	<b>\$2,343.4</b>
Drainage	\$189.8	\$403.0	\$394.0	\$529.7	\$1,516.5
Floodplain Management	\$19.8	\$25.4	\$29.4	\$34.1	\$108.6
Ohio River Flood Protection	\$128.1	\$175.6	\$191.2	\$145.9	\$640.9
Stormwater Quality (MS4)	\$11.2	\$19.8	\$21.5	\$25.0	\$77.5
<b>Support Systems</b>	<b>\$43.5</b>	<b>\$28.7</b>	<b>\$24.9</b>	<b>\$27.4</b>	<b>\$124.5</b>
Capital Equipment	\$11.3	\$14.7	\$16.7	\$19.0	\$61.8
Facilities	\$27.7	\$8.3	\$3.2	\$2.7	\$41.9
IT	\$3.1	\$3.8	\$3.1	\$3.6	\$13.6
LOJIC	\$1.4	\$1.9	\$1.8	\$2.1	\$7.3
<b>Total Escalated Costs</b>	<b>\$1,240.4</b>	<b>\$1,044.7</b>	<b>\$1,014.7</b>	<b>\$1,024.7</b>	<b>\$4,324.5</b>



**Figure 1.6-14. Projected Facility Plan Capital Improvement Plan and Recommendations**

### Debt Service (P+I) on Senior and Subordinate Obligations (net of Capitalized Interest)



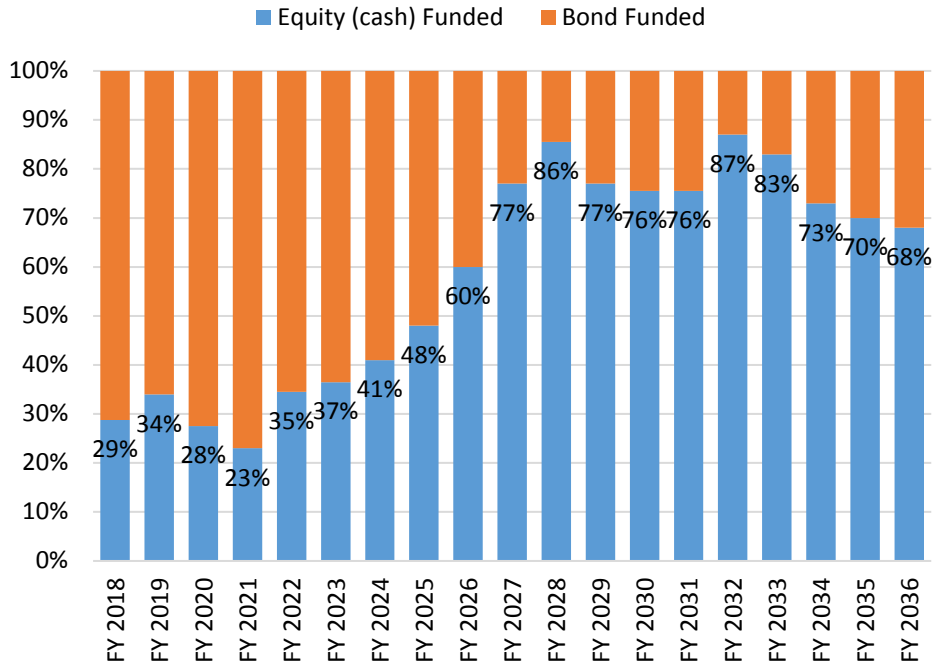
**Figure 1.6-15. Existing Debt Service (P+I) on Senior and Subordinate Obligations (Net of Capitalized Interest) (Millions of Dollars)**

#### 6.16.2.2 Equity (Cash)-Funded Capital Improvement Plan

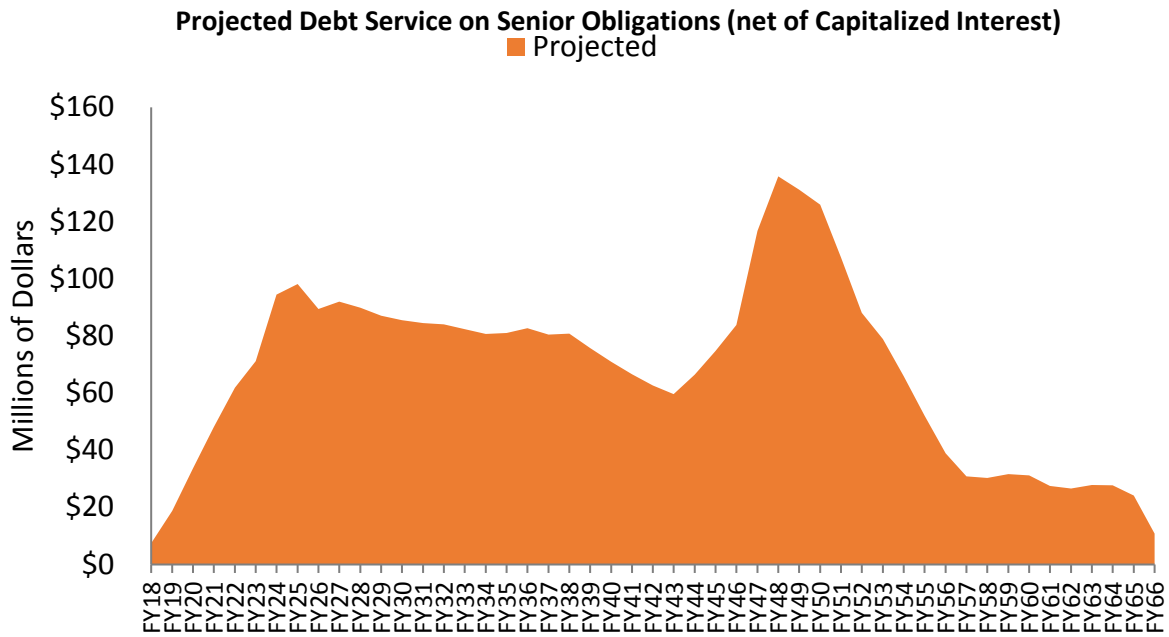
To achieve a minimum ending working capital balance of 250 days of net operating costs, the amount of equity (cash)-funded CIP was adjusted. Figure 1.6-16 summarizes the percentage of CIP equity (cash)-funded per year compared to the amount that is debt funded. The percentage of equity (cash)-funded CIP varies year to year, because if excess working capital is available, it is used to cash-fund projects. This in turn helps reduce the amount borrowed and the amount of interest expensed.

#### 6.16.2.3 Projected Debt Service

The projected debt service on new debt issues was estimated based the total capital needs less the amount that is equity (cash) funded plus an allowance for cost of issuance (1 percent) and bond reserve (4 percent). To estimate the debt service payments, the calculation assumes a 30-year term and 4.5 percent interest rate. Debt service payments are wrapped around MSD’s existing debt in a manner similar to the approach used by MSD for the Series 2017A bonds. A graph of projected debt service is provided in Figure 1.6-17. The projected debt service is for senior obligations and does not include subordinate obligations.



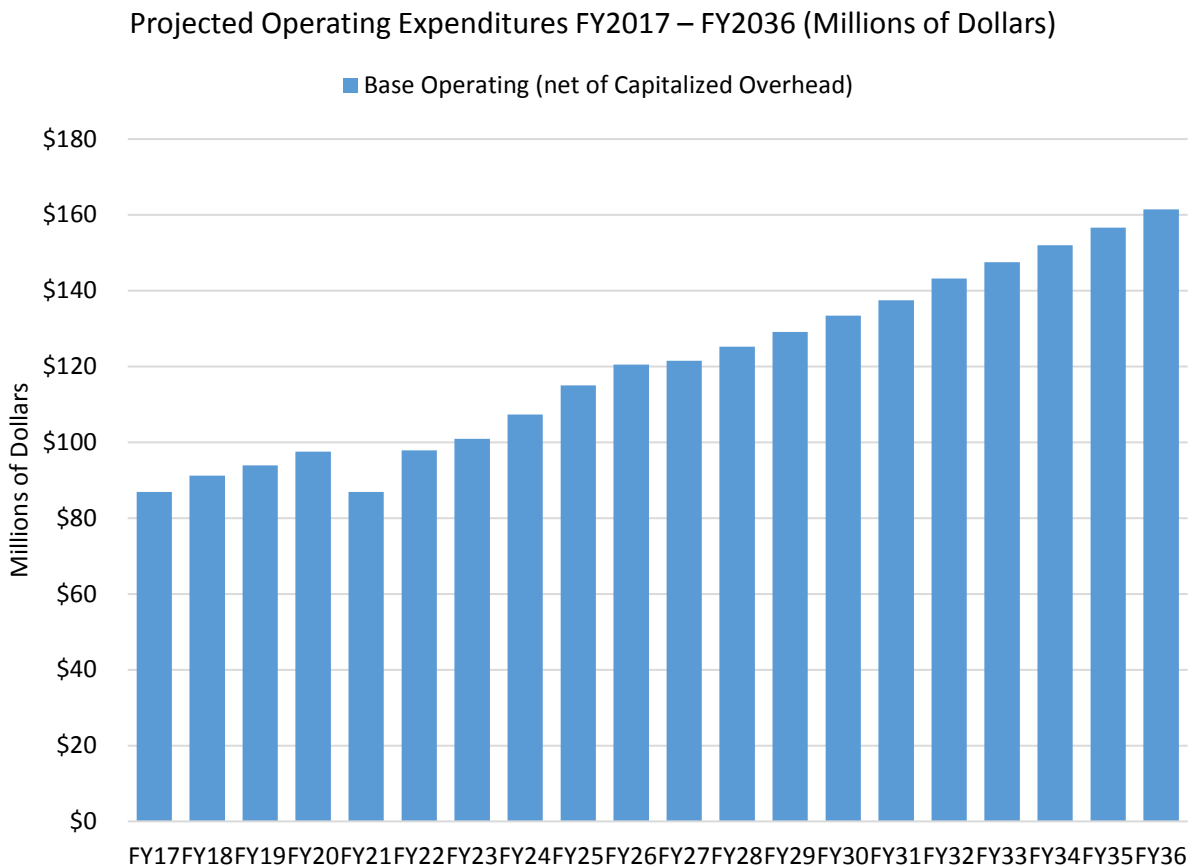
**Figure 1.6-16. Projected Equity (Cash) versus Bond Funding for Capital Improvement Plan Spending (FY2017 to FY2036)**



**Figure 1.6-17. Projected Debt Service (P+I) on Senior Obligations (net of Capitalized Interest) (Millions of Dollars)**

### 6.16.3 Projected Operating Expenses

System operating expenses (net of capitalized operating costs) are projected to be \$86.9 million in FY2017 and increase to \$97.9 million in FY2018. From FY2018 through FY2036, normal or continuing operating expenses are projected to increase at an average annual rate of 3 percent. Additional O&M expenses associated with the IOAP program and other capital improvements to the system are projected to begin affecting the utility in FY2018, when additional O&M expenses of \$1,600,000 per year are anticipated. Additional operating expenses are expected to increase on an annual basis, adding about \$2 million to the total operating expense in FY2019 and over \$25 million in FY2036. Figure 1.6-18 provides a graphical summary of the projected operating expenses from FY2017 to FY2036.

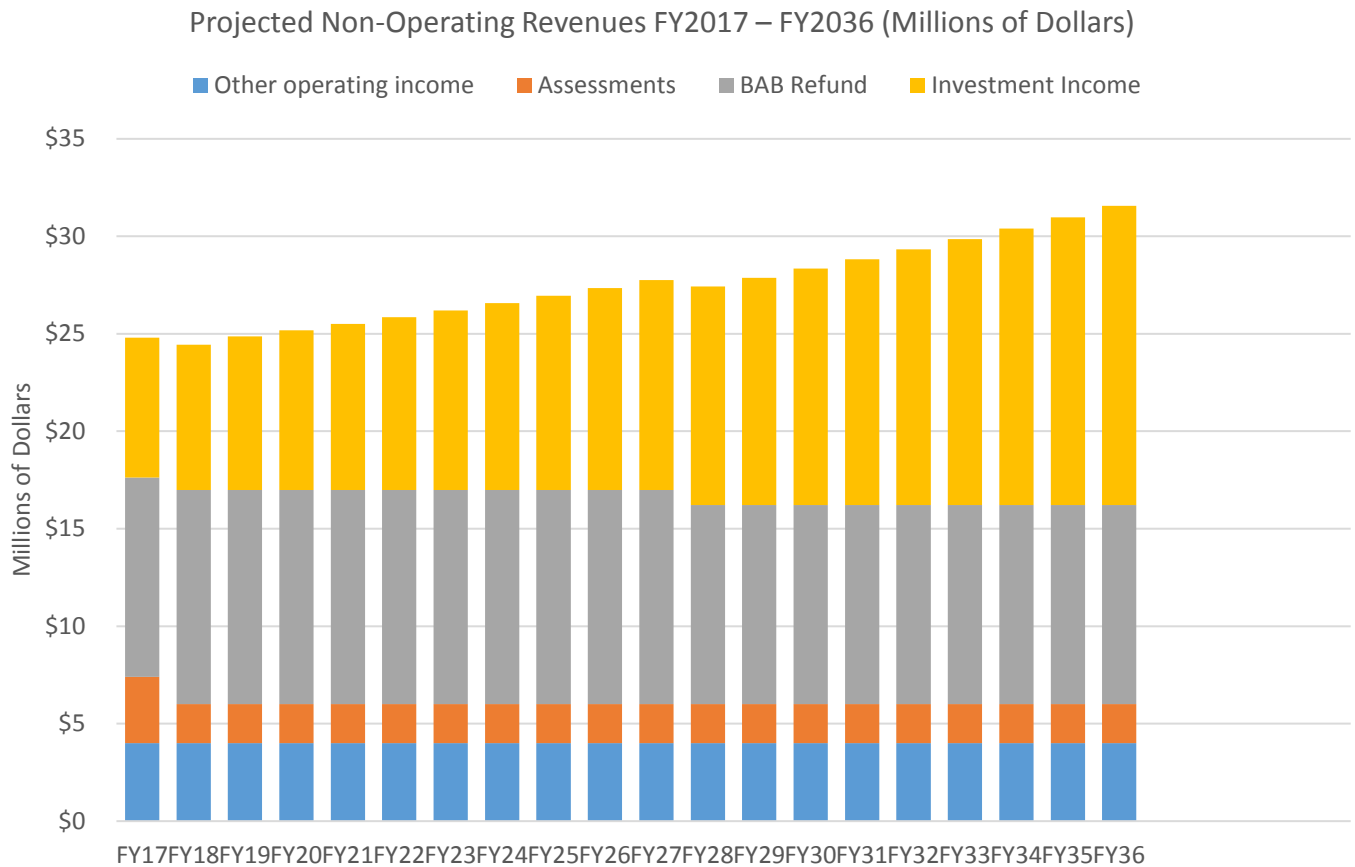


**Figure 1.6-18. Projected Net Operating Expenditures FY2017 to FY2036 (Millions of Dollars)**

### 6.16.4 Non-Operating Revenues

Non-operating revenues consist of revenues not generated from user charges, including the service charge (based on meter size), commodity charge (based on volume), Consent Decree surcharge, and

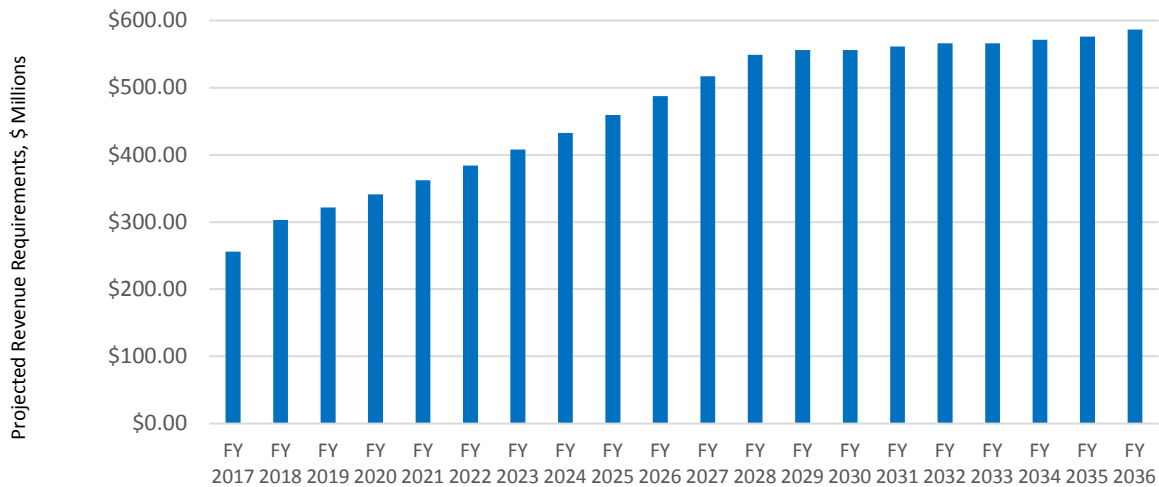
drainage charge (based on impervious area). Non-operating revenues include items such as BAB Refund, investment income, and assessments. The BAB Refund is based on the debt service schedule for Series 2009C and 2010A. The amount varies from \$10 million in FY2017 to \$2 million in FY2036. It is possible that the BAB Refund levels could decrease based on changes instituted by the federal government. Figure 1.6-19 provides a graphical summary of the projected non-operating revenues from FY2017 to FY2032.



**Figure 1.6-19. Projected Non-Operating Revenues FY2017 to FY2032 (Millions of Dollars)**

### 6.16.5 Projected Operating Revenue Requirements

Based on the projections summarized for operating expenditures, debt service, equity (cash) fund CIP, and less non-operating revenues, Figure 1.6-20 provides a graphical summary of the projected revenue requirements for FY2017 to FY2036. This represents the program costs (less non-operating revenues) to be funded by user charges (wastewater and drainage). Projected revenue requirements are forecasted to increase from \$219 million in FY2017 to \$266.2 million in FY2018, and \$300.1 million in FY2019.



**Figure 1.6-20. Projected Operating Revenue Requirements FY2017 to FY2036 (Millions of Dollars)**

### 6.16.6 Projected Working Capital and Rate Adjustments

Table 1.6-51 summarizes the projected working capital (available revenues minus expenditures) and forecast rate adjustments. The forecast rate adjustments are assumed to apply uniformly to both the wastewater and drainage service charges. For FY2018, a 23 percent rate adjustment is assumed. For FY2019 to FY2036, annual adjustments are based on meeting two tests: minimum ending working capital of 250 days net operating (270 day target) and Debt Service Coverage Ratio (DSCR) rising to a target of 200 percent by the end of the planning period. Subsequent rate adjustments are projected to be less than 6.9 percent annually.



**Table 1.6-51. MSD 20-Year Facility Plan Recommended Rate and Financial Summary (Millions of Dollars)**

	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	FY2034	FY2035	FY2036
	Actual	Forecast	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected	Projected
<b>Available Revenues <sup>1</sup></b>																					
Wastewater service charges	\$183.6	\$196.5	\$234.9	\$248.7	\$263.3	\$278.7	\$295.1	\$312.4	\$330.7	\$350.1	\$370.6	\$392.4	\$415.4	\$420.7	\$420.7	\$424.2	\$427.8	\$427.8	\$431.5	\$435.2	\$442.6
Stormwater service charges	54.9	59.3	72.9	78.0	83.4	89.1	95.3	101.8	108.8	116.4	124.4	133.0	142.1	144.3	144.3	145.7	147.2	147.2	148.7	150.1	153.1
<b>Total Service Charges</b>	<b>238.5</b>	<b>255.8</b>	<b>307.9</b>	<b>326.7</b>	<b>346.6</b>	<b>367.8</b>	<b>390.3</b>	<b>414.2</b>	<b>439.5</b>	<b>466.4</b>	<b>495.0</b>	<b>525.3</b>	<b>557.5</b>	<b>564.9</b>	<b>564.9</b>	<b>570.0</b>	<b>575.0</b>	<b>575.0</b>	<b>580.1</b>	<b>585.3</b>	<b>595.7</b>
Percent Change in Revenues		7.3%	20.3%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%	1.3%	0.0%	0.9%	0.9%	0.0%	0.9%	0.9%	1.8%
Target Percent Change in Revenue		6.9%	23.0%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	1.5%	0.0%	1.0%	1.0%	0.0%	1.0%	1.0%	2.0%
WRAP Discounts	-	-	(5.0)	(5.3)	(5.6)	(5.9)	(6.3)	(6.6)	(7.0)	(7.5)	(7.9)	(8.4)	(8.8)	(9.0)	(9.0)	(9.0)	(9.1)	(9.1)	(9.2)	(9.3)	(9.4)
Miscellaneous revenues <sup>4</sup>	31.5	25.0	24.7	25.1	25.4	25.8	26.1	26.4	26.8	27.2	27.6	28.0	27.7	28.1	28.6	29.1	29.6	30.1	30.6	31.2	31.8
Bond Proceeds (New Money)	175.0	150.0	175.0	196.0	200.6	229.4	136.9	144.0	138.2	117.6	83.7	44.1	29.1	52.3	55.6	55.6	33.7	60.1	68.7	76.3	
<b>Total Available Funds</b>	<b>445.0</b>	<b>430.8</b>	<b>502.5</b>	<b>542.5</b>	<b>567.0</b>	<b>617.0</b>	<b>547.0</b>	<b>578.0</b>	<b>597.5</b>	<b>603.8</b>	<b>598.4</b>	<b>589.1</b>	<b>605.5</b>	<b>636.4</b>	<b>640.1</b>	<b>645.6</b>	<b>621.0</b>	<b>629.7</b>	<b>661.7</b>	<b>675.9</b>	<b>694.4</b>
<b>Expenditures</b>																					
Operating <sup>2</sup>	118.6	117.3	125.6	129.4	133.3	137.3	141.4	145.7	150.0	154.5	159.2	164.0	168.9	174.0	179.2	184.6	190.1	195.8	201.7	207.7	214.0
Contingency Reserve			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Incremental O&M			1.6	2.0	4.8	9.1	10.1	11.3	12.0	12.6	13.7	14.4	17.0	17.8	18.5	19.3	20.2	22.2	23.1	24.1	25.2
Senior Debt Service <sup>3</sup>	118.6	101.5	108.1	121.5	135.5	151.9	166.1	176.3	181.0	189.0	189.6	206.6	200.5	198.5	177.9	155.6	155.5	153.9	213.7	214.8	217.4
Subordinate (BAN and SWAP) <sup>7</sup>	18.0	13.6	13.6	14.1	14.1	14.1	14.1	14.3	19.5	19.5	25.9	12.6	19.2	19.0	38.7	60.3	60.4	60.5	-	-	-
CIP	191.0	177.0																			
CIP: Consent Decree (Escalated)			139.5	154.4	89.7	71.1	13.3	8.5	4.3	0.2	0.2	0.2	0.2	-	-	-	-	-	-	-	-
CIP: All Other Capital			95.0	126.2	171.8	210.4	184.2	205.8	217.0	213.6	197.6	181.0	189.8	215.0	214.3	214.3	185.4	187.2	210.5	216.3	225.3
Increase (decrease) in debt service reserve <sup>6</sup>	3.2	15.0	4.1	7.8	8.0	9.2	5.5	5.8	5.5	4.7	3.3	1.8	1.2	2.1	2.2	2.2	1.0	1.3	2.4	2.7	3.1
Bond issuance costs	1.3	3.6	3.9	2.9	3.0	3.4	2.1	2.2	2.1	1.8	1.3	0.7	0.4	0.8	0.8	0.8	0.4	0.5	0.9	1.0	1.1
<b>Total Expenditures</b>	<b>450.7</b>	<b>427.9</b>	<b>496.3</b>	<b>563.4</b>	<b>565.1</b>	<b>611.4</b>	<b>541.8</b>	<b>574.7</b>	<b>596.4</b>	<b>600.8</b>	<b>595.7</b>	<b>586.1</b>	<b>602.3</b>	<b>632.1</b>	<b>636.6</b>	<b>642.2</b>	<b>618.0</b>	<b>626.4</b>	<b>657.3</b>	<b>671.8</b>	<b>691.0</b>
<b>Annual Change in Working Capital</b>	<b>23.4</b>	<b>2.9</b>	<b>6.2</b>	<b>(20.9)</b>	<b>1.9</b>	<b>5.6</b>	<b>5.3</b>	<b>3.2</b>	<b>1.1</b>	<b>3.0</b>	<b>2.7</b>	<b>2.9</b>	<b>3.2</b>	<b>4.3</b>	<b>3.5</b>	<b>3.4</b>	<b>3.0</b>	<b>3.3</b>	<b>4.4</b>	<b>4.1</b>	<b>3.3</b>
<b>Year-end Working Capital</b>	<b>\$85.0</b>	<b>\$87.9</b>	<b>\$94.1</b>	<b>\$73.2</b>	<b>\$75.1</b>	<b>\$80.7</b>	<b>\$86.0</b>	<b>\$89.2</b>	<b>\$90.3</b>	<b>\$93.3</b>	<b>\$96.1</b>	<b>\$99.0</b>	<b>\$102.2</b>	<b>\$106.5</b>	<b>\$110.1</b>	<b>\$113.4</b>	<b>\$116.5</b>	<b>\$119.8</b>	<b>\$124.2</b>	<b>\$128.3</b>	<b>\$131.7</b>
<b>Operating + Incremental O&amp;M + Contingency Reserve</b>	<b>118.6</b>	<b>117.3</b>	<b>132.2</b>	<b>136.4</b>	<b>143.1</b>	<b>151.3</b>	<b>156.5</b>	<b>162.0</b>	<b>167.0</b>	<b>172.1</b>	<b>177.9</b>	<b>183.4</b>	<b>190.9</b>	<b>196.7</b>	<b>202.7</b>	<b>208.9</b>	<b>215.2</b>	<b>223.0</b>	<b>229.8</b>	<b>236.9</b>	<b>244.2</b>
<b>Capitalized Project Management (Force Account)</b>	<b>(\$30.5)</b>	<b>(\$30.4)</b>	<b>(\$34.4)</b>	<b>(\$35.5)</b>	<b>(\$35.8)</b>	<b>(\$36.3)</b>	<b>(\$36.0)</b>	<b>(\$40.5)</b>	<b>(\$41.7)</b>	<b>(\$43.0)</b>	<b>(\$44.5)</b>	<b>(\$45.8)</b>	<b>(\$47.7)</b>	<b>(\$49.2)</b>	<b>(\$50.7)</b>	<b>(\$52.2)</b>	<b>(\$53.8)</b>	<b>(\$55.7)</b>	<b>(\$57.4)</b>	<b>(\$59.2)</b>	<b>(\$61.0)</b>
<b>Net Operating Costs <sup>5</sup></b>	<b>88.1</b>	<b>86.9</b>	<b>97.9</b>	<b>100.9</b>	<b>107.3</b>	<b>115.0</b>	<b>120.5</b>	<b>121.5</b>	<b>125.2</b>	<b>129.1</b>	<b>133.4</b>	<b>137.5</b>	<b>143.2</b>	<b>147.5</b>	<b>152.0</b>	<b>156.7</b>	<b>161.4</b>	<b>167.2</b>	<b>172.3</b>	<b>177.7</b>	<b>183.1</b>
<b>Equity (cash) Funded CIP <sup>12</sup></b>			<b>\$67.4</b>	<b>\$95.4</b>	<b>\$71.9</b>	<b>\$64.7</b>	<b>\$68.1</b>	<b>\$78.2</b>	<b>\$90.8</b>	<b>\$102.6</b>	<b>\$118.7</b>	<b>\$139.5</b>	<b>\$162.4</b>	<b>\$165.5</b>	<b>\$161.8</b>	<b>\$161.8</b>	<b>\$161.3</b>	<b>\$155.3</b>	<b>\$153.6</b>	<b>\$151.4</b>	<b>\$153.2</b>
<b>Debt Service Summary</b>																					
Senior Debt Service <sup>3</sup>	118.6	\$121.1	\$129.00	\$141.66	\$157.02	\$174.92	\$190.12	\$200.96	\$206.14	\$214.57	\$215.24	\$232.04	\$225.20	\$222.64	\$201.54	\$179.02	\$178.72	\$176.85	\$236.61	\$237.16	\$239.29
Capitalized Interest <sup>8</sup>	(21.1)	(\$19.59)	(\$20.93)	(\$20.17)	(\$21.56)	(\$23.05)	(\$24.05)	(\$24.64)	(\$25.16)	(\$25.57)	(\$25.66)	(\$25.40)	(\$24.65)	(\$24.10)	(\$23.65)	(\$23.41)	(\$23.22)	(\$22.96)	(\$22.88)	(\$22.31)	(\$21.93)
Total Net Senior Obligations	97.6	\$101.49	\$108.07	\$121.49	\$135.46	\$151.87	\$166.07	\$176.32	\$180.97	\$189.00	\$189.58	\$206.63	\$200.55	\$198.54	\$177.89	\$155.61	\$155.50	\$153.89	\$213.73	\$214.85	\$217.36
Subordinate (BAN and SWAP) <sup>7</sup>	18.0	\$13.29	\$14.29	\$14.29	\$14.29	\$14.29	\$14.29	\$14.29	\$19.50	\$19.50	\$25.85	\$12.57	\$19.24	\$19.04	\$38.70	\$60.34	\$60.40	\$60.53	\$0.00	\$0.00	\$0.00
<b>Key Ratios</b>																					
Operating Ratio	36%	33%	31%	31%	31%	31%	31%	29%	28%	27%	27%	26%	25%	26%	27%	27%	28%	29%	30%	30%	31%
% Equity Funded CIP	36%	44%	29%	34%	28%	23%	35%	37%	41%	48%	60%	77%	86%	77%	76%	76%	87%	83%	73%	70%	68%
DSCR Senior Obligations <sup>10</sup>	186%	191%	213%	202%	191%	180%	174%	177%	185%	189%	201%	197%	216%	220%	243%	278%	279%	279%	201%	200%	200%
DSCR Senior and Subordinate Obligations <sup>11</sup>	163%	169%	189%	181%	173%	164%	161%	164%	167%	171%	177%	186%	197%	201%	200%	201%	200%	200%	201%	200%	200%
Senior Interest Ratio	43%	41%	34%	32%	30%	29%	27%	26%	19%	18%	18%	22%	19%	19%	12%	4%	4%	4%	25%	25%	24%
<b>Moody's Ratios</b>																					
Debt Service Coverage Ratio	133%	169%	193%	185%	177%	168%	164%	167%	170%	175%	181%	190%	201%	205%	204%	205%	205%	204%	205%	204%	204%
Debt to Operating Revenue	780%	776%	705%	708%	729%	736%	714%	691%	666%	636%	599%	557%	511%	496%	488%	479%	468%	464%	459%	446%	430%
Days Cash on Hand	352	369	351	265	255	256	260	268	263	264	263	263	261	264	264	264	263	261	263	264	262

<sup>1</sup> Assumes wastewater and stormwater rate adjustments in order to meet DSCR and Working Capital targets.  
<sup>2</sup> Assumes 3.0% annual increase in operating expenses from 2019 to 2036.  
<sup>3</sup> Includes principal and interest for existing and projected senior obligations. Projected debt service assumes repayment schedule at 30 years at 4.5%.  
<sup>4</sup> Includes BAB Refund (Series 2009C and 2010A), investment income, other operating, and assessments.  
<sup>5</sup> Operating Cost, plus the contingency reserve, plus Additional O&M Projections, minus MSD Capital Project Management.  
<sup>6</sup> Based on 4% of current year bond par amount.  
<sup>7</sup> Amortization of BAN principal assumed to level out overall debt structure. Assumes BAN interest — 2%, Est. net swap payments assumes 1-month LIBOR rate at 0.23%.  
<sup>8</sup> Assumes 20% of interest expense on existing and projected bond obligations.  
<sup>9</sup> Includes Bond-Funded CIP, COI, change in Bond Reserve.  
<sup>10</sup> (Wastewater and Stormwater service charges plus Miscellaneous Revenues less Low Income Rate Relief minus Net Operating) divided by (Senior DS less Capitalized Interest)  
<sup>11</sup> (Wastewater and Stormwater service charges plus Miscellaneous Revenues less Low Income Rate Relief minus Net Operating) divided by (Senior DS less Capitalized Interest plus Subordinate DS)  
<sup>12</sup> Equity (cash) Funded CIP = Total CIP - (Bond Par Amount - COI - Bond Reserve)

## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

### CHAPTER 7 IMPLEMENTATION PLAN

#### 7.1 OPERATIONAL PLAN

This Facility Plan presents a recommended 20-year CIP that totals \$4.3 billion. The projects in this plan encompass the full scope of MSD’s service offerings, ranging from new WQTCs to drainage culverts. Many projects have been proposed that will improve energy efficiency, replace labor-intensive processes and aging equipment, or reduce the amount of extraneous water that enters the system, thereby reducing treatment costs. Conversely, there are several large CSO storage basins that will require additional O&M, along with new or expanded facilities elsewhere in the system.

##### 7.1.1 Capital Delivery

The Facility Plan recommends a CIP that will average over \$200 million per year for the next 20 years. To properly plan, design, and construct those projects requires a CIP delivery system that can sustain a high level of productivity. In response to the *Consent Decree Mid-Point Review* completed in 2015 by CDM-Smith, MSD recognized weaknesses in its project delivery systems. Knowing that this Facility Plan would recommend delivering a sustained high volume of capital construction over the next two decades, MSD recognized that a complete “retooling” of the project delivery system was required.

To accomplish this, MSD has reorganized its Engineering Division to provide “cradle-to-commissioning” project management. MSD has initiated development of a best practices project management toolset using Microsoft Project and SharePoint software. Project management training has been initiated and the engineer of record roles and responsibilities expanded to support MSD construction activities.

The Engineering Division has 100 approved positions in FY2017. This number of approved positions was established to address the workload anticipated for FY2017 to FY2019. Seventeen of the 100 approved positions were vacant in September 2016. More significantly, 11 of the vacant positions were in the Technical Services group, which is tasked with most of the capital project delivery. These 11 positions represent 30 percent of the Technical Services group’s 37 approved positions for FY2017. For MSD to successfully deliver the projects recommended in the Facility Plan, the vacant positions should be filled as soon as qualified candidates can be found. A comprehensive focus on career development and training is recommended to continually improve project delivery skills in the Engineering Division, to maximize effectiveness of the current staff, and to provide for succession planning and further career opportunities for staff.

##### 7.1.2 Operations and Maintenance

An important part of asset management is providing adequate resources to operate and maintain the asset after it is constructed. MSD’s current 5-year financial plan assumes a 3-percent per year increase in operating costs. To account for the new facilities recommended as part of this Facility Plan, incremental

O&M costs must be added to the base O&M budget. In addition, several major facilities being constructed under the IOAP have incremental operating costs not yet realized in MSD's O&M budget. Finally, the Oxygen Generation Area (OGA) replacement project will decommission the existing cryogenic oxygen generation system and replace it with a vendor-supplied and operated oxygen generation system. This switch will reduce power costs and labor costs to operate the existing system, but will add operating costs in the fees paid to the vendor for oxygen delivered. Tables 1.7-1a and 1.7-1b illustrate the incremental operating costs that must be added to the baseline O&M costs for future financial projections.

To ensure that the projects in the Facility Plan can be constructed, operated, and maintained, a review of the required staff resources is presented in Table 1.7-2a and 1.7-2b.

## **7.2 COMPLIANCE MONITORING**

The IOAP developed the overflow control parameters based on a demonstration approach. This means that IOAP projects, in total, must achieve the overflow control performance specified in the IOAP. To document that the projects being constructed under the IOAP are meeting their individual performance measures, MSD has a very rigorous post-construction compliance monitoring program that applies to all IOAP projects.

Facility Plan projects do not, for the most part, have the same type of regulatory performance reporting requirement. However, this does not mean that Facility Plan projects are exempt from meeting performance expectations when they are complete. Many projects will contribute to sustaining WQTC performance and overflow control to continue CWA compliance well beyond the term of the ACD.

Experience in demonstrating performance on the IOAP has shown that it is difficult to determine a blanket approach to performance monitoring. The first line of performance monitoring that should be mandatory is performance testing to demonstrate compliance with the requirements of the project specifications. A rigorous and well-documented performance testing program, delivered by the contractor, will address the performance testing needs for most projects in the Facility Plan.

Treatment projects and some pump station projects require additional performance testing, beyond what the contractor is required to provide. In these cases, the performance testing is checking the adequacy of the process design rather than the constructed facility. This is critical to demonstrate that the project will contribute to sustained compliance with all requirements of the CWA or other applicable laws and regulations. To implement a project-specific performance test, the engineer of record should be required to develop a performance testing protocol at the 30-percent design level. This becomes the standard that the design engineer expects to achieve, and can be the basis for project post-construction compliance testing. See Volume 1, Chapter 6 for examples of post-construction compliance monitoring approaches.



**Table 1.7-1a. Incremental Operating Cost (FY2018 through FY2027)**

Incremental Operating Costs	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
Facility Plan Wastewater Incremental O&M	-\$473,000	-\$700,236	-\$721,243	-\$779,664	-\$735,247	-\$942,782	-\$971,066	-\$1,012,866	-\$1,003,221	-\$947,780
OGA Replacement Vendor Fees	\$1,800,000	\$1,800,000	\$1,854,000	\$1,909,620	\$1,966,909	\$2,025,916	\$2,086,693	\$2,149,294	\$2,213,773	\$2,280,186
IOAP Remaining Incremental Costs	\$300,000	\$895,000	\$1,902,000	\$2,672,000	\$3,307,000	\$4,149,000	\$4,412,000	\$4,647,000	\$5,322,000	\$5,481,660
Catch-up Total Costs	\$1,291,181	\$2,739,611	\$4,359,654	\$4,625,129	\$4,906,771	\$5,205,565	\$5,522,554	\$5,858,846	\$6,215,619	\$6,594,117
<b>Incremental O&amp;M Cost Wastewater (No Morris Forman WQTC)</b>	<b>\$2,918,181</b>	<b>\$4,734,375</b>	<b>\$7,394,411</b>	<b>\$8,427,085</b>	<b>\$9,445,433</b>	<b>\$10,437,699</b>	<b>\$11,050,181</b>	<b>\$11,642,275</b>	<b>\$12,748,170</b>	<b>\$13,408,183</b>
Incremental Drainage and Flood Protection O&M Cost	\$0	\$0	\$0	\$31,739	\$72,918	\$237,975	\$245,114	\$252,467	\$260,041	\$267,843
Catch-up Total Costs	\$315,361	\$406,028	\$585,492	\$603,057	\$621,148	\$639,783	\$658,976	\$678,746	\$699,108	\$720,081
<b>Total Incremental O&amp;M Cost Drainage and Flood Protection</b>	<b>\$315,361</b>	<b>\$406,028</b>	<b>\$585,492</b>	<b>\$634,796</b>	<b>\$694,066</b>	<b>\$877,758</b>	<b>\$904,090</b>	<b>\$931,213</b>	<b>\$959,149</b>	<b>\$987,924</b>
<b>Total Incremental Operating Cost</b>	<b>\$3,233,543</b>	<b>\$5,140,403</b>	<b>\$7,979,902</b>	<b>\$9,061,881</b>	<b>\$10,139,499</b>	<b>\$11,315,456</b>	<b>\$11,954,271</b>	<b>\$12,573,487</b>	<b>\$13,707,319</b>	<b>\$14,396,107</b>

**Table 1.7-1b. Incremental Operating Cost (FY2028 through FY2036)**

Incremental Operating Costs	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	FY2034	FY2035	FY2036
Facility Plan Wastewater Incremental O&M	\$757,635	\$780,364	\$803,775	\$827,888	\$852,725	\$1,482,648	\$1,527,127	\$1,572,941	\$1,620,129
OGA Replacement Vendor Fees	\$2,348,592	\$2,419,049	\$2,491,621	\$2,566,370	\$2,643,361	\$2,722,662	\$2,804,341	\$2,888,472	\$2,975,126
IOAP Remaining Incremental Costs	\$5,646,110	\$5,815,493	\$5,989,958	\$6,169,657	\$6,354,746	\$6,545,389	\$6,741,750	\$6,944,003	\$7,152,323
Catch-up Total Costs	\$6,995,665	\$7,421,666	\$7,873,610	\$8,353,076	\$8,861,741	\$9,401,382	\$9,973,886	\$10,581,254	\$11,225,610
<b>Incremental O&amp;M Cost Wastewater (No Morris Forman WQTC)</b>	<b>\$15,748,002</b>	<b>\$16,436,573</b>	<b>\$17,158,964</b>	<b>\$17,916,991</b>	<b>\$18,712,573</b>	<b>\$20,152,080</b>	<b>\$21,047,105</b>	<b>\$21,986,670</b>	<b>\$22,973,188</b>
Incremental Drainage and Flood Protection O&M Cost	\$537,775	\$553,908	\$570,525	\$587,641	\$605,270	\$1,141,588	\$1,175,836	\$1,236,137	\$1,273,221
Catch-up Total Costs	\$741,684	\$763,934	\$786,852	\$810,458	\$834,771	\$859,815	\$885,609	\$912,177	\$939,543
<b>Total Incremental O&amp;M Cost Drainage and Flood Protection</b>	<b>\$1,279,459</b>	<b>\$1,317,842</b>	<b>\$1,357,377</b>	<b>\$1,398,099</b>	<b>\$1,440,041</b>	<b>\$2,001,403</b>	<b>\$2,061,445</b>	<b>\$2,148,314</b>	<b>\$2,212,764</b>
<b>Total Incremental Operating Cost</b>	<b>\$17,027,460</b>	<b>\$17,754,415</b>	<b>\$18,516,341</b>	<b>\$19,315,089</b>	<b>\$20,152,614</b>	<b>\$22,153,483</b>	<b>\$23,108,550</b>	<b>\$24,134,984</b>	<b>\$25,185,951</b>

The incremental O&M costs in Tables 1.7-1a and 1.7-1b were developed from a diverse set of source documents, the division between labor and materials could not be calculated directly. Existing O&M budgets were examined to identify the incremental staffing levels required to operate and maintain the new facilities.

In wastewater treatment, labor makes up approximately 45 percent of the O&M budget. In collection systems and stormwater operations, labor is approximately 85 percent of O&M budgets. In treatment, the average National Association of Government Employees union wage rate is approximately \$28 per hour. With benefits added, this wage rate is estimated at \$45 per hour. In collection systems and stormwater operations, the average Laborers' International Union of North America union rate is approximately \$20 per hour, which is estimated at \$32 per hour with benefits.

Tables 1.7-2a and 1.7-2b reflect the calculated O&M costs from Section 5.3 at the aforementioned wage rate estimations to show incremental staffing needs.



Table 1.7-2a. Incremental Operating Staff (FY2017 through FY2026)

Incremental Staff Positions	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026
<b>Total Incremental Wastewater Costs</b>	<b>\$4,247,500</b>	<b>\$7,480,329</b>	<b>\$5,607,757</b>	<b>\$7,755,169</b>	<b>\$6,861,196</b>	<b>\$7,624,289</b>	<b>\$7,991,553</b>	<b>\$8,321,264</b>	<b>\$9,146,437</b>
Wastewater Labor Costs	\$195,000	\$581,750	\$1,236,300	\$1,736,800	\$2,149,550	\$2,696,850	\$2,867,800	\$3,020,550	\$3,459,300
Wastewater Staff positions	2	7	14	19	22	27	28	29	32
Wastewater Catch-up Staff Positions (unit)	5	10	15	15	15	15	15	15	15
Wastewater Catch-up Staff Positions (non-unit)	7	14	21	21	21	21	21	21	21
<b>Incremental Drainage &amp; Flood Protection O&amp;M Cost</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$31,739</b>	<b>\$72,918</b>	<b>\$237,975</b>	<b>\$245,114</b>	<b>\$252,467</b>	<b>\$260,041</b>
Drainage and Flood Protection Labor costs	\$0	\$0	\$0	\$26,978	\$61,980	\$202,279	\$208,347	\$214,597	\$221,035
Drainage and Flood Protection Staff Positions (unit)	0	0	0	0	1	3	3	3	3
Drainage and Flood Protection Catch-up Staff positions (unit)	4	5	7	7	7	7	7	7	7
<b>Total Incremental Staff Positions</b>	<b>18</b>	<b>36</b>	<b>57</b>	<b>62</b>	<b>66</b>	<b>73</b>	<b>74</b>	<b>74</b>	<b>77</b>

Table 1.7-2b. Incremental Operating Staff (FY2027 through FY2036)

Incremental Staff Positions	FY2027	FY2028	FY2029	FY2030	FY2031	FY2032	FY2033	2034	FY2035	FY2036
<b>Total Incremental Wastewater Costs</b>	<b>\$9,506,335</b>	<b>\$11,525,518</b>	<b>\$11,871,139</b>	<b>\$12,227,361</b>	<b>\$12,594,224</b>	<b>\$12,971,973</b>	<b>\$13,965,394</b>	<b>\$14,384,387</b>	<b>\$14,815,972</b>	<b>\$15,260,442</b>
Wastewater Labor Costs	\$3,583,602	\$4,198,261	\$4,324,208	\$4,453,934	\$4,587,553	\$4,725,179	\$5,043,705	\$5,195,015	\$5,350,866	\$5,511,392
Wastewater Staff positions	32	36	36	36	36	36	38	38	38	38
Wastewater Catch-up Staff Positions (unit)	15	15	15	15	15	15	15	15	15	15
Wastewater Catch-up Staff Positions (non-unit)	21	21	21	21	21	21	21	21	21	21
<b>Incremental Drainage and Flood Protection O&amp;M Cost</b>	<b>\$267,843</b>	<b>\$537,775</b>	<b>\$553,908</b>	<b>\$570,525</b>	<b>\$587,641</b>	<b>\$605,270</b>	<b>\$1,141,588</b>	<b>\$1,175,836</b>	<b>\$1,236,137</b>	<b>\$1,273,221</b>
Drainage and Flood Protection Labor costs	\$227,667	\$457,109	\$470,822	\$484,946	\$499,495	\$514,480	\$970,350	\$999,461	\$1,050,716	\$1,082,238
Drainage and Flood Protection Staff Positions (unit)	3	5	5	5	5	5	9	9	9	9
Drainage and Flood Protection Catch-up Staff positions (unit)	7	7	7	7	7	7	7	7	7	7
<b>Incremental Staff Positions</b>	<b>78</b>	<b>84</b>	<b>84</b>	<b>84</b>	<b>84</b>	<b>84</b>	<b>90</b>	<b>90</b>	<b>90</b>	<b>90</b>

## VOLUME 1—PROGRAMMATIC AND INTEGRATING INFORMATION

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