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Sustainable Water Reclamation

February 2012

The Milwaukee Metropolitan Sewerage District

MMSD
Preserving The Environment • Improving Water Quality

Fresh Coast Green Solutions

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contents

Executive Summary

Sustainability is a rich part of the MIlwaukee Metropolitan Sewerage District's (MMSD) history, integral to present-day operations, and critical to our future. Focused initially on water reclamation and resource recovery, our mission is evolving over time to encompass many overlapping facets of environmental and public health. This plan summarizes our early beginnings and where we are today: a nationally recognized utility leader in water resource protection. At MMSD, we take seriously our on-going charge of helping to protect the region's precious water resources.

South Shore Water Reclamation Facility

Our location on the western shores of Lake Michigan is a symbol of the important work we do in conveying, storing and treating wastewater, managing out-of-bank flooding, and reducing stormwater discharges to area waterways. To accomplish this, we work together with our 29 satellite municipalities (including Milwaukee County), non-governmental organizations, and the general public. It is no accident that this region was designated a Global Compact City (for water) by the United Nations, won the Leadership Award for an ongoing commitment to addressing stormwater impacts through green infrastructure from the Great Lakes and St. Lawrence Cities Initiative, and was selected as a Smarter City focusing on urban agriculture/aquaculture by IBM. In the eyes of the world, water is a business we do well in this region. Faced with abundance, we are charged with its wise use and protection and that, in turn, shapes our mission and actions at MMSD.

Although the region is rich in water, there is a recognition that water is a resource not to be squandered, but rather used for the gift it is. We do our part to manage that gift well, stewarding regional efforts and innovating approaches to carry us through the future. Our grey infrastructure system is one of the premier systems in the world, collecting, conveying, storing and treating wastewater and combined storm/wastewater in all except the very largest of storms. In recent years, we have put additional focus on reducing stormwater in the system through private property inflow/infiltration and green infrastructure efforts. With a changing climate that's bringing more intense precipitation events more frequently, it has never been more important to manage precipitation that falls on the land. We continue our vital, innovative efforts as change agents on this front.

Innovation is needed.
"Imagination is everything.
It is the preview of life's
coming attractions."

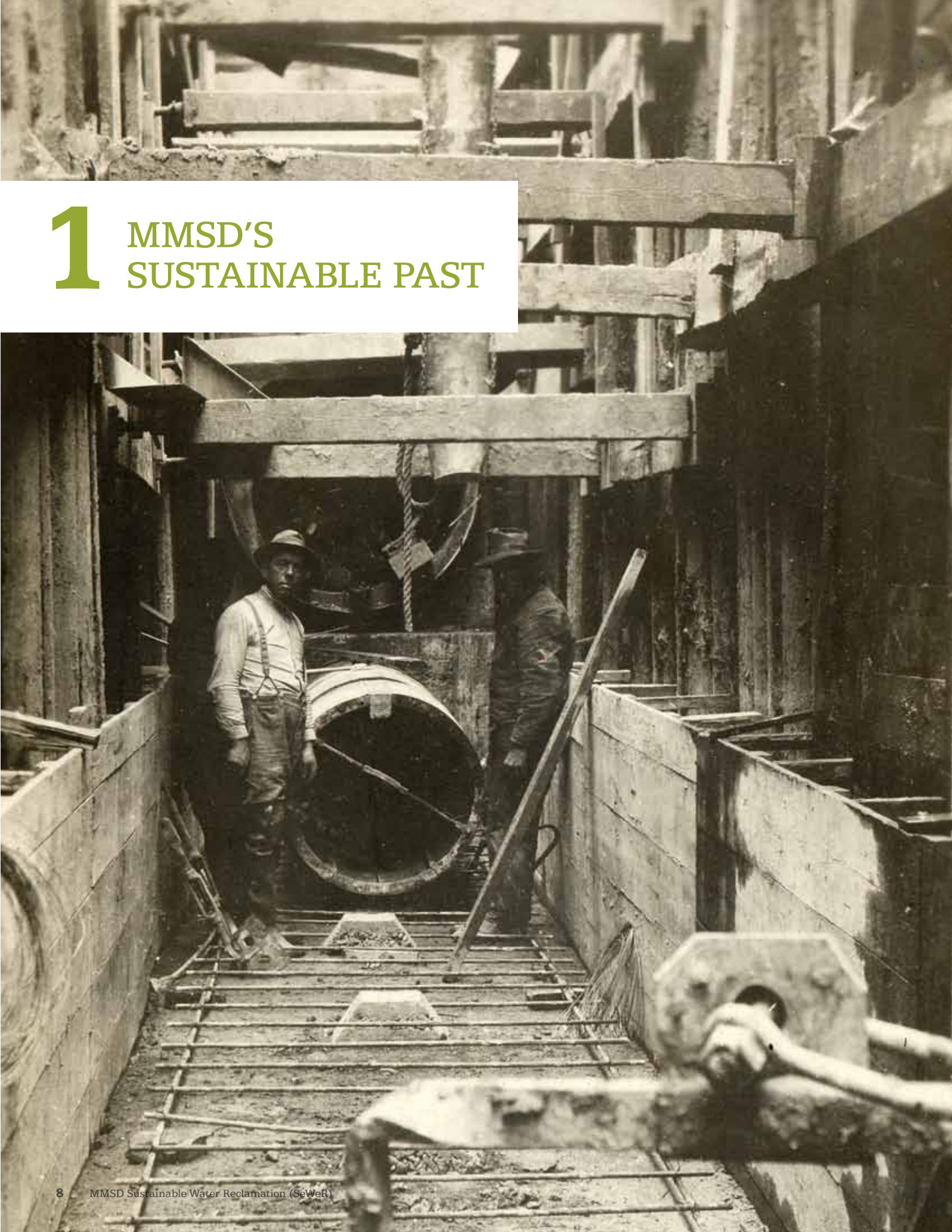
— Albert Einstein

As a public agency, fiscal responsibility and protection of the public health, safety and general welfare are always top considerations in what we do. Designing projects that have multiple benefits and working with many partners increases our effectiveness and promotes regional collaboration. We've learned through the years that regional collaboration is absolutely key to protecting and conserving water resources.

This plan is primarily about our future, but no look to the future is complete without first looking back and taking stock of where we are today. Chapters 1 and 2 are dedicated to that end, summarizing where we've come from and our foundations forward. Chapters 3 through 10 provide a window to our shared future. These chapters explain why we care about each topic, ways we might move forward to continue to meet challenges, and goals we might set in doing so. Chapter 11 provides a framework for the rewarding work to come.

At MMSD, we will continue to play a strong role in this region's collaborative efforts to improve the region's water resources. This is a crucial responsibility that builds heavily on our sustainable past and relies on relationships with partners throughout Greater Milwaukee. By identifying and assembling winning partner combinations for projects and programs that benefit this region, we can help ensure a sustainable tomorrow.

Jeff Martinka (Sweet Water Trust, Inc.), Judy Beck (Great Lakes National Program Office, US Environmental Protection Agency), Nancy Frank (University of Wisconsin Milwaukee), Kevin Shafer (Executive Director, MMSD)



1 MMSD'S SUSTAINABLE PAST

Sustainability is not an endpoint at the Milwaukee Metropolitan Sewerage District (MMSD), but rather it is the pathway forward. It's about ensuring we do our part to protect the region's environmental health, support social sustainability, and be fiscally responsible. By doing this, we want to help ensure future generations in southeastern Wisconsin have the same opportunities that current generations have. At MMSD, we hope this provides a good example for the region we've come to know as the Greater Milwaukee Watersheds.

A day at McKinley Beach

MMSD is no stranger to sustainability. We invented Milorganite® (**MIL**waukee's **ORGA**nic **NIT**rogen) using process biosolids—otherwise considered waste products—more than 85 years ago. As a result of this and other treatment process innovations along the way, waterbodies in the region continue to benefit from significantly improved water quality and people benefit from less chance for water-borne illnesses.

But how did it start?

In 1913, nearly 100 years ago, the State of Wisconsin passed an act creating the Milwaukee Sewerage Commission, providing the means for raising funds to build Milwaukee's first water reclamation facility. As a result, we completed constructing the Jones Island Water Reclamation Facility (JIWRF) in 1925. In the early years after the JIWRF was built, our sustainability efforts focused on cleaning up the region's black and septic rivers and lakes, protecting the public's health, and—even then—finding ways to use waste as a resource.

MMSD's mid-century adolescent years continued to focus on water quality improvements in sustainable ways. For instance, in the mid-1970s we began to capture methane gas from digesters and use it to generate electricity at the South Shore Water Reclamation Facility (SSWRF). As part of the Water Pollution Abatement Program in the late 1970s, we put additional focus on research and water quality monitoring. Regularly monitoring the health of the rivers and lakes since then has enabled us to identify areas that are in need of protection and/or restorative action. The increased interest in environmental health at this time was founded in Wisconsin's strong environmental tradition, and fueled by federal environmental legislation in the 1970s.

In the 2000s, formal recognition of "sustainability" became the path forward at MMSD, with our programs like:

- The Conservation Plan (later called Greenseams®) beginning in 2000,
- Stormwater best management practice (BMP) program beginning in 2003,
- MMSD Commission adoption of a formal sustainability policy statement in 2005,
- Consideration of sustainability in the selection of capital project alternatives in 2008,
- MMSD Commission adoption of a clear 2035 Vision Statement in 2011.

Today, that environmental ethic lives on as we continue to incorporate sustainable practices into our everyday functions at MMSD. For instance, we continue to make our facilities as green as possible through efforts like widespread recycling, energy efficient heating, cooling and lighting systems, sustainable purchasing, and employee wellness programs. We have also installed solar power at the JIWRF, we're building a 19-mile landfill gas pipeline to take advantage of landfill gas that's currently flared, and we will install energy-efficient turbines to take advantage of renewable energy. We have also created programs like those for green infrastructure that incentivize and promote the use of sustainable stormwater management, and there's much more!

As with any journey, the sustainable pathway forward provides ample opportunity for public education. As shown by a recent survey* by the Southeastern Wisconsin Watersheds Trust, Inc., the public is generally unaware of the impact they have on water quality. Our present and future efforts should include outreach to help the public understand how they can affect not only environmental outcomes like better water quality, but also social and economic outcomes associated with the sanitary and storm systems, as well as what they can do to help.

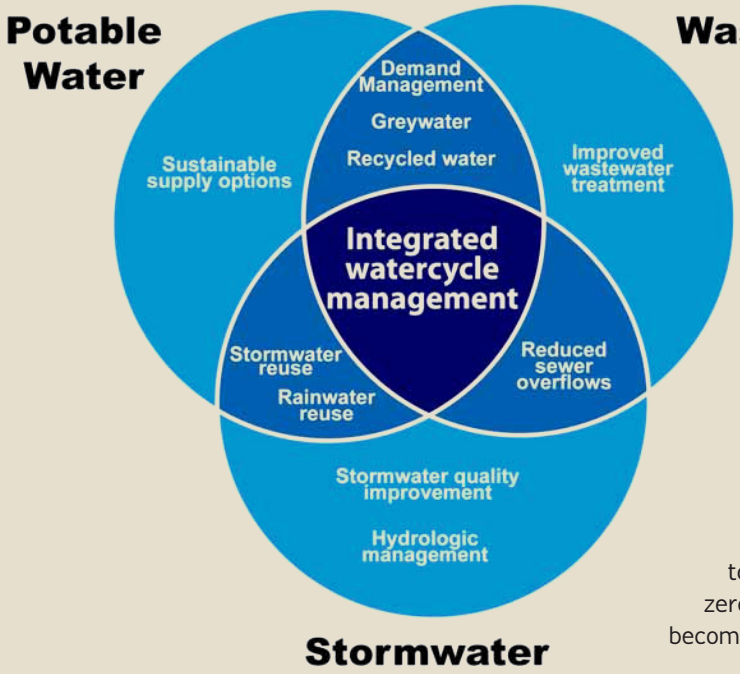
Moving forward, we recognize the benefits of continuing to minimize our environmental impact while also saving money, reducing energy use, improving the health of the region's communities, and increasing the public's awareness about environmental issues—particularly those issues centered around water. This is reflected in the types of projects we pursue and hope to catalyze throughout the region like green infrastructure, energy efficiency/renewable energy and overall social/economic sustainability related to water reclamation. Our sustainable pathway forward is outlined in the chapters that follow.

* 2010 Sweetwater Trust Inc. survey results accessed August 22, 2011: http://www.swwtwater.org/home/SurveyResults.cfm.

Jones Island Water Reclamation Facility Solar Panels

Nick Bristol Photography

Prairie Restoration



Sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own needs *(Report of the World Commission on Environment and Development, 1987)*. The economy, society and environment (or profits, people and planet) are equally important in a sustainability framework. MMSD embraces sustainability as an overall core value and operational philosophy through Commission Policy 1-11.04.

Some concepts of sustainability consider moving toward zero, whether it's zero toxins in air emissions, zero discrimination, or zero waste. In MMSD's case, this becomes zero overflows and zero basement backups.

Other concepts of sustainability consider zero but a step on the road to sustainability. Regenerative development or design considers working with the earth's natural systems to help rebuild natural capital, repair the capacity of natural systems and, over time, increase capital or capacity (or both). In MMSD's case this likely becomes regenerative stormwater conveyance that provides much more than simple conveyance. It also includes treatment, infiltration, solids removal and runoff reduction. Green infrastructure fits this bill.

graphic ©waterbydesign.com.au/whatdowedo/


Water Quality Sampling


South Shore WRF


KK River Sediment Testing

1925 River and harbor water sampling was initiated to quantify the health of the rivers and harbor.

1926 Milorganite® was created to reuse dried biosolids as an organic fertilizer high in nitrogen.

1970 MMSD research program had its early beginnings with a study of the circulation in Milwaukee's Harbor, monitoring discharges from the treatment plants and determining how to improve the treatment process.

1975 Methane/biogas was captured and burned to generate electricity for South Shore Water Reclamation Facility.

1979 MMSD Water Quality Monitoring Program was expanded to include many new sites and more in-depth readings and samples.

Small, Women and Minority Business Enterprise Program was started to promote entrepreneurs in the local community.

1982 Industrial Waste Pretreatment Program was created to protect the sewage treatment system by regulating industrial discharges.

1985 MMSD Regional Estuary Study began monitoring the health and inner workings of the Milwaukee Estuary.

1986 Harbor sediment was tested to study the transport of sediments from the rivers as well as the effect of the Jones Island Water Reclamation Facility on the harbor.

Sustainability Timeline


Hybrid Fleet Vehicles


Medicine Collection


Rain Barrel


Fresh Coast Document


Household Hazardous Waste


Rockwell International Green Roof


Deep Tunnel


Greenseams® Property

1990 MMSD laboratory and headquarters facilities began purchasing products made from recycled materials, and a recycling program was started.

1994 The Deep Tunnel came online dropping MMSD's overflows from 50-60 per year to 2-3 per year.

1998 The Household Hazardous Waste Collection Program began, allowing homeowners to drop off commercial products that might otherwise pollute water (paint, oil, cleaners, etc.).

2000 The Conservation Plan began purchasing key lands along waterways.

Watercourse Management Plans detailing floodplain reconnection, concrete removal and overall flood management was completed.

2001 MMSD launched a full education and outreach program to help the public better understand MMSD and water reclamation.

The Corridor Study, a three-phase study related to waterbodies' health and understanding, was initiated.

2003 Best Management Practices Partnership Program was created, providing matching funds for green infrastructure projects.

2004 MMSD Rain Barrel Program was started. The program recycled 55-gallon drums from local food businesses and retrofitted them for stormwater capture.

2005 The Conservation Plan was weaved into the expanded Greenseams® Program, better connecting Conservation Plan properties along waterways.

MMSD Commission approved and published a Policy Statement dedicated to sustainability.

2006 Medicine Collection Day began collecting unused and unwanted medicines to keep them out of the sewer system and to stem the abuse of prescription drugs.

2008 LEED Standards were adopted for building procedures and janitorial materials.

2009 "Fresh Coast Green Solutions," an educational guide book, was released to promote the use of green infrastructure within the region.

MMSD and the Great Lakes WATER Institute's Pathogens Study, focusing on paths of human fecal contaminants in waterways, was published.

2010 Fleet vehicles were replaced with more efficient hybrids and natural gas vehicles.

Regional Green Roofs Initiative program allocated $5 million to implement green roofs in the region.

2011 MMSD's 2035 Vision was adopted and included a sustainable bottom line to reach future goals.

H2OCapture.com, an interactive website that allows the public and municipal managers to investigate the benefits of green infrastructure, was launched.

MMSD Rain Barrel Community Donation event donated 500 rain barrels to areas hardest hit by basement backups and flooding.

2 SUSTAINABLE FOUNDATIONS

Urban Ecology Center's Rain Garden

While initially founded to clean up the region's impaired rivers and lakes and protect the public's health, MMSD's mission has grown to support achieving water quality standards in receiving waters (Clean Water Act (CWA), 1972) and to protect property. Healthy communities begin not only with proper sanitation but also with greenspace, natural functioning environments, resource conservation and public involvement. We are committed to engaging in projects that further these beginnings.

At MMSD, we know that we are among many entities in the region interested in sustainability, and that there are many leaders and partners to collaborate and cooperate. A regional approach to sustainability cannot be underestimated, and we hope to play a strong and positive role in the region's social, economic and environmental sustainability efforts.

There have been many efforts over the past decade that have clearly supported how we at MMSD move forward toward a sustainable future. These include a 2005 sustainability policy statement, a sustainability worksheet or matrix we use to evaluate our capital project alternatives, a strategic plan, and a Vision Statement for 2035.

2005 Sustainability Policy

By embracing sustainability as an overall core value and operational philosophy, we focus services and processes to preserve the natural environment and reduce the consumption, waste and emissions we generate. A summary of the 2005 Sustainability Policy adopted by the MMSD Commission states: "The foundation[s] for MMSD's sustainability philosophy are its policies, practices and programs that: encourage and optimize the use of renewable, recyclable, eco-friendly materials; reduce energy consumption and emissions from fossil fuels; and have a positive impact on the region's economic, social and environmental resources while maintaining the desired level-of-services in a financially responsible manner." This policy is important because its concepts and principles guide all capital and operations and maintenance work undertaken by and on behalf of MMSD.

Capital Project Alternatives Worksheet

To better consider how the 2005 sustainability policy manifests itself in our capital project alternatives when a project is in planning and design, MMSD staff developed an alternatives worksheet to make objective comparisons between alternatives. The worksheet is used by our staff and consultants to evaluate feasible project alternatives at MMSD and their impacts on energy, water, waste, finances and society. While we always consider minimizing costs in our projects, the worksheet helps staff to also consider other factors when recommending a preferred project alternative.

MMSD's Landfill Gas Pipeline Project

Strategic Plan Objectives

In addition to these sustainability developments, MMSD's Strategic Plan provides short-term direction regarding sustainability. Our current Strategic Plan covers a three-year period spanning 2010 to 2012. It provides the framework or roadmap to achieve our goals, ensuring resources are properly allocated to do so. There are four goal areas in the Strategic Plan, with associated strategic objectives as follows:

+ **Environmental:** The District's principle environmental objective is meeting regulatory requirements of its point sources (sanitary sewer overflow, combined sewer overflow, water reclamation facilities effluent, groundwater monitoring program, industrial waste pretreatment program, and water quality monitoring program). Strategically speaking, the District recognizes that in pursuing its environmental purpose, its goal is to do so in a way that has additional positive impact on the environment.

+ **Financial:** The District will provide long-range financial planning for both its capital and operations and maintenance budgets, identifying expenditure areas for analysis of the lowest-cost options with a goal to provide, to the extent possible, stable and sustainable user charge billings and tax levies.

+ **Leadership:** Throughout its history, the District has taken the lead on many initiatives that now position it as one of the premier water reclamation and water quality agencies in the Nation. It is the goal of the District to continue this leadership by identifying sustainable initiatives through research and planning and spearheading positive change.

+ **Business Process:** To be sustainable, the District needs to not only assess its impact on the external environment but also assess how it operates. The District's business process goal is to operate at a level that maximizes efficiency, produces effective results, and minimizes physical and procedural waste.

MMSD's Planning Area

2035 Vision Statement

In September 2009, MMSD's Executive Director drafted and published a Vision Statement for the year 2035. The Vision Statement ignited discussion at many levels, and as a result the MMSD Commission established an ad-hoc committee of internal and external advisors to refine the 2035 Vision Statement for Commission approval (approved January 2011, see last page).

Guiding principles
of the approved 2035 Vision Statement include:

+ **Sustainable Bottom Line:** Future planning, design and operational decisions will be made based on a sustainable bottom line approach, also referred to as a triple bottom line approach. This approach considers balanced economic, environmental, operational and social values. It recognizes that benefits are many and varied, and may not always be easily quantifiable.

+ **Water Quality Leadership and Collaboration:** MMSD will continue to expand its leadership role in developing regional approaches to protecting and improving water quality. MMSD will continue to develop and foster strategic alliances in its planning and project implementation. MMSD will continue to advocate for a watershed approach to managing the region's water resources and to managing its own operations.

Two Strategic Objectives were developed within these guiding principles. They include:

+ **Integrated Watershed Management:**
An integrated approach to watershed management must be established that responds to inter-jurisdictional opportunities and limitations. This integrated approach will focus on the infrastructure of the watersheds, seeking a healthy balance between two types of infrastructure: **GREY AND GREEN**.

+ **Climate Change Mitigation/Adaptation with an Emphasis on Energy Efficiency:**
Climate change has had an effect on recent precipitation patterns, and precipitation has a direct effect on the region's sanitary and storm sewer systems. Becoming more efficient and renewable with energy usage will help MMSD adapt to a changing climate, but there is recognition that climate change may have significant impacts on the District in ways beyond energy usage.

In the chapters that follow, MMSD shares with you...

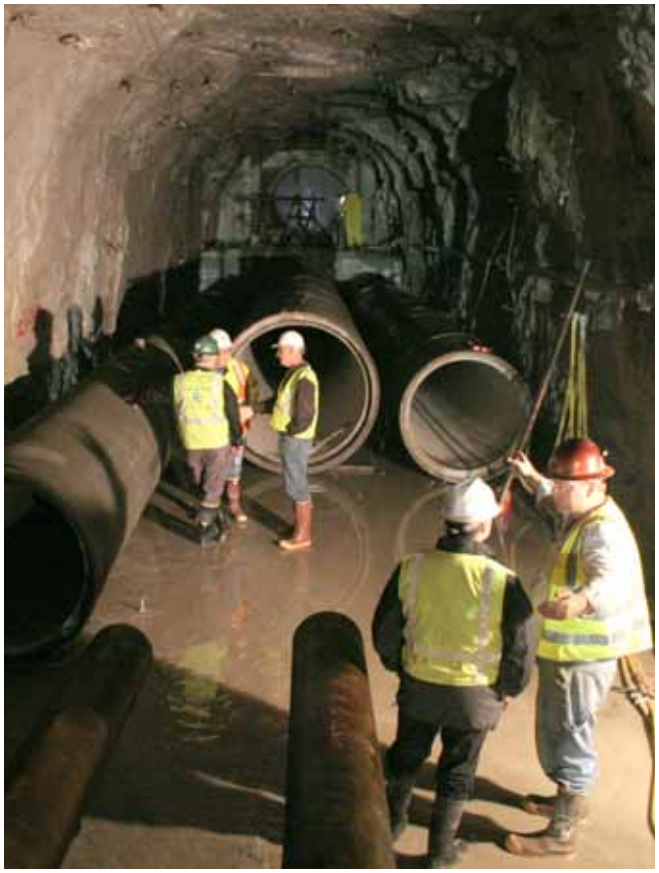
Why we care
What we can do
What goals we have set

3 MMSD'S GREY INFRASTRUCTURE

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our **GREY** infrastructure?

Our grey infrastructure—sewer pipes and water reclamation facilities—is the very backbone of the sanitary and combined sewer system. By conveying, storing, treating and returning wastewater and combined stormwater/wastewater to nature, MMSD protects the region's water resources.



Construction of the Harbor Siphon Tunnel

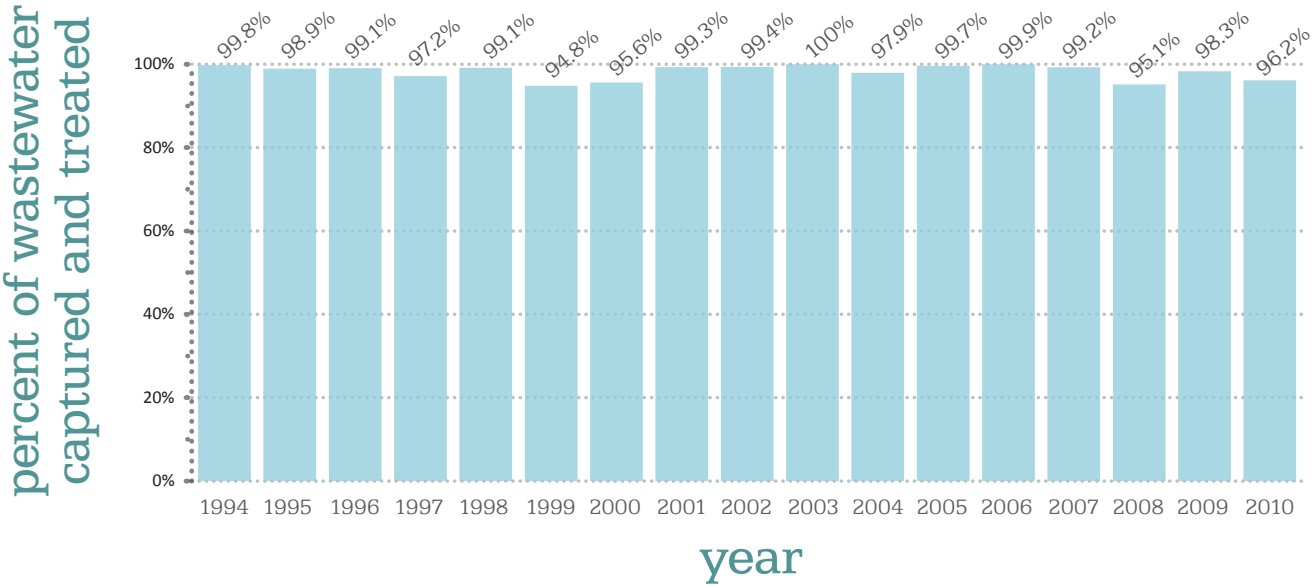
Why we care...

At MMSD, we know that adhering to the requirements set forth in our state-issued discharge permit pursuant to the Clean Water Act is vitally important. Meeting permit requirements for wastewater discharge limits, however, does not ensure area waterways meet water quality standards. In fact, reducing (or even eliminating) combined sewer overflows and sanitary sewer overflows will result in little further overall improvement in water quality.*

* MMSD 2020 Facilities Plan, Milwaukee Metropolitan Sewerage District, 2007. http://v3.mmsd.com/wqifacilitiesplanreport.aspx accessed 9/15/2011.

One part of MMSD's conveyance, storage and treatment system is known as the Inline Storage System (ISS) or "Deep Tunnel." The ISS was constructed as deep as 300 feet underground and can hold 432 million gallons. The Northwest Side Relief Sewer can hold an additional 89 million gallons. Under extreme storms, the system temporarily stores wastewater and combined wastewater/stormwater until the water reclamation facilities can handle it. Since it went online in late 1993, MMSD's ISS has prevented about 91 billion gallons of wastewater from polluting Lake Michigan (2011).

Deep Tunnel Construction

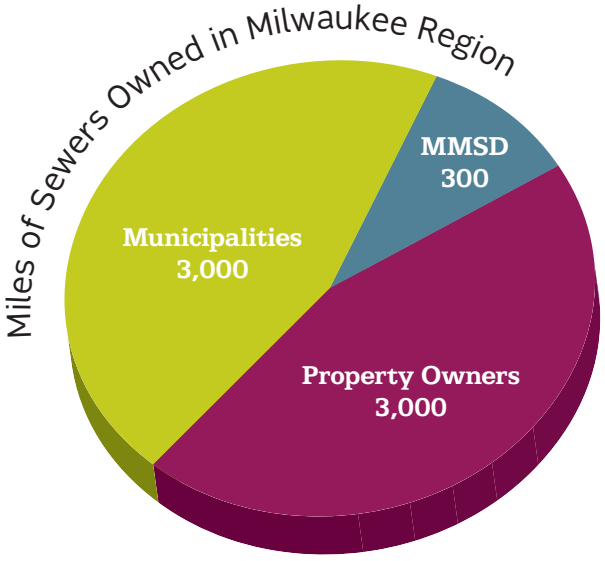


Prior to completing the Inline Storage System (ISS) and other capacity enhancements in the Metropolitan Interceptor Sewer (MIS) system and at the water reclamation facilities, MMSD experienced 50 to 60 system overflows annually. Because of the ISS and the capacity enhancements constructed as part of the Water Pollution Abatement Program, overflows from our system now happen between two and three times per year on average. This measure of overflows may be better represented by "percent capture" to consistently track performance trends, as shown in the figure (above).

Grey infrastructure is an absolutely essential component of the MMSD system. Regardless of ownership pipes in the ground convey wastewater to one of two reclamation facilities. Where water is reclaimed, so too are nutrients managed, pollutants removed, and the lake protected—all for the benefit of the public's health, safety and general welfare. Grey infrastructure requires replacement and maintenance over time; it is important that energy, materials, and treatment efficiency are considered as the sewerage system is cared for.

Overlook at Milwaukee County Grounds Flood Management Facility

Menomonee River Before (Top), After (Bottom) Reconstruction



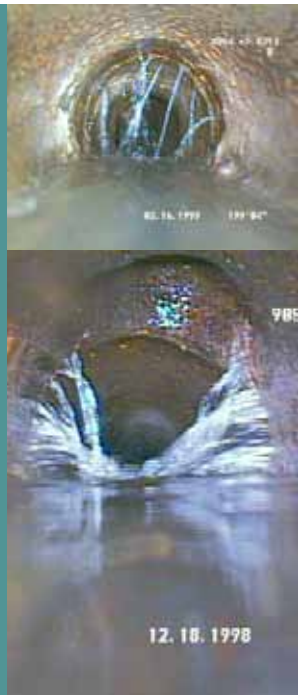
MMSD is a regional authority, and the sewerage system is rounded out by public/municipal and private property systems. While MMSD owns and maintains about 300 miles of sewers, public/municipal sewers comprise about 3,000 miles and private property sewers another 3,000 miles. There remain misconceptions about the ownership of sewers, and this issue is a reoccurring theme in public outreach conducted by MMSD and others (see chart at left).

Maintaining and providing capacity in MMSD, public/municipal, and private property systems is crucial. There's no magic solution to eliminating basement backups and sewer overflows when severe weather strikes and causes flooding, but well-planned and well-maintained grey infrastructure with adequate capacity provides a legally supportable and permitted level of protection. We seek to do our part in protecting and maintaining the region's sewers so they can do their job!

To ensure facilities are right-sized for population and land use conditions and to continue to comply with regulations well into the future, MMSD undertakes planning at regular intervals. Planning was last initiated in 2002 and completed in 2007 together with the Southeastern Wisconsin Regional Planning Commission (SEWRPC) through a joint effort known as the Water Quality Initiative (WQI). Recommendations of the WQI in the MMSD's 2020 Facilities Plan are for a five-year level of protection (LOP). That LOP is based on a projection of "wastewater recurrence" (or how water flowing in sewers behaves) that exceeds the standards the system is designed to handle once in five years, on average.

Leaky Lateral Pipe

Inflow and infiltration have been shown to be a significant problem in urban areas with aging systems. This is a problem seen across the US. In Wauwatosa, Wisconsin, for instance, inflow/infiltration rates up to 55 gallons per minute were identified on private property. These findings are likely typical of conditions in older urban areas.



Actual Recorded Inspections

What we can do...

The connected labyrinth of private and public/municipal sewers feeds to MMSD, and so it's important that we help private property owners and municipalities maintain their systems to reduce the flow of stormwater to the sanitary sewer system through inflow and infiltration (I/I). It's also important that green infrastructure holds back flows to combined sanitary and storm sewers that make up about five percent of our tributary region. We can accomplish this through combinations of approaches including: education and outreach, technical assistance, collaboration, and financial assistance.

MMSD's 2020 Facilities Plan makes several recommendations for wet weather control, and those recommendations should continue to be implemented:

- Provide an additional 150 million gallons per day (MGD) physical-chemical secondary treatment capacity at the SSWRF (following a verification project).
- Increase pumping capacity from the inline pump station to the JIWRF to meet a total firm pumping capacity of 180 MGD.
- Undertake nine additional Metropolitan Interceptor Sewer (MIS) projects to address hydraulic constraints when warranted by conditions.
- Build an additional MIS segment in Franklin, Muskego, and New Berlin to accommodate projected population growth.
- Regardless of growth, continue to develop and implement a comprehensive sustainable program to manage I/I in the municipally owned sewer systems served by MMSD.
- Continue to meet regulatory requirements for combined sewer overflows without additional facilities through the year 2020.

An interim recommendation was also made in the 2020 Facilities Plan to continue to produce Milorganite® while also evaluating the possibility of combining Milorganite® with other technologies, considering cost and environmental impact. In addition, a variety of water reclamation facility and conveyance system recommendations were provided in the plan. All of the above was recommended under a "plan-do-check-act" implementation process known as adaptive implementation, and was set forth in the context of working with regional partners to advance and achieve the regional water quality goals and objectives.

MMSD plans to implement these recommendations, and will be initiating the next round of facilities planning in the next few years. Future facilities planning will rely on this sustainability plan as one of its many source documents to ensure that sustainability continues to be woven throughout MMSD's plans for the future. We will undoubtedly work with numerous partners in the process of planning to best meet goals.

MMSD also plans to further exploit the ability of water reclamation facilities to manage nutrients and biosolids. We currently remove nutrients from so-called "wastewater" to meet permit requirements and protect water resources.

Private Property Lateral Lining in Brown Deer Neighborhood

We also use nutrients to make organic fertilizer (Milorganite® at JIWRF) and biosolids (through anaerobic digestion) to produce energy (biogas at SSWRF). Additional biosolids use and nutrient removal could be considered for more or different types of energy (see Chapter 6) and fertilizer production (see Chapter 5) not fully recovered now, such as heat and phosphorus. Going forward, we can and should consider how to extract and reuse even more of what's in reclaimed water for more beneficial uses.

What goals have we set...

Achieve zero sanitary sewer overflows, zero combined sewer overflows and zero basement backups to the extent feasible, while also taking a regenerative approach to the constituents found in wastewater.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Help support the rehabilitation of municipal and private sanitary systems to reduce I/I from impacting MMSD's system.
- Maximize MMSD's system capacity through new facilities/technologies, policies, operational procedures and programs through formal facilities planning every 10 years or as warranted.
- Initiate the next round of facilities planning to include sustainability as a core concept.

4 MMSD'S GREEN INFRASTRUCTURE

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our **GREEN** infrastructure?

Our green infrastructure—*upstream strategies that work with nature to hold and infiltrate stormwater*—provides additional capacity to the region's sewers. Green infrastructure not only reduces the volume of water needing to be treated, but it also filters polluted stormwater runoff, protecting the region's water resources.

Why we care...

MMSD is one of many entities in southeastern Wisconsin helping the region selectively weave a blanket of green infrastructure into the region's urban/suburban fabric. Green infrastructure is an approach to wet weather management that is cost-effective, sustainable, and environmentally friendly. It helps manage stormwater by infiltrating it into the ground closer to where the precipitation falls, allowing plants to take it up through root systems and evapotranspire it to the atmosphere. It also helps capture and either hold or slow down the natural flow of water to discharge points. It cannot replace the capacity of grey infrastructure in metropolitan regions, but it can add needed capacity to clean and reduce the amount of stormwater runoff and provide resiliency to the landscape.

Green infrastructure is both “clean” and “lean”:

Green and Clean: Green infrastructure can CLEAN polluted stormwater runoff, filtering it before it reaches area waterways. Without any treatment, polluted stormwater runoff can and does impair our waters, making it difficult to support aquatic plant and animal life, becoming potentially detrimental to drinking water and making it otherwise difficult to meet water quality standards.

Green and Lean: Green infrastructure can REDUCE the volume of stormwater that runs across the surface of the land, capturing and infiltrating precipitation where it falls. In that sense, green infrastructure can be an important component of an integrated green and grey stormwater system designed to manage large storms when too much stormwater leaking into sanitary sewer systems and adding water to the combined sewer systems can lead to basement backups and overflows to area waterways. Green infrastructure is important in providing some additional capacity to the conveyance system during wet weather.

In addition, the climate in the Milwaukee region appears to be getting wetter, albeit with some seasonal variation (see state precipitation diagrams in Chapter 7). Increasingly severe storms have occurred in recent years and this trend is predicted to continue according to climate experts from the Wisconsin Initiative on Climate Change Impacts. Green infrastructure can help manage additional volumes of stormwater, providing a valuable component of an overall stormwater management approach. Beyond stormwater management, green infrastructure can help protect cities against climate change by reducing the urban heat island effect and by sequestering carbon. When native vegetation that requires less water is used, green infrastructure can be more drought tolerant. Temperature control can also help to reduce energy used for heating and cooling buildings by keeping indoor building temperatures more stable, especially during outdoor temperature variations. More information about climate change is provided in Chapter 7.

Green infrastructure provides many benefits beyond managing stormwater and acting as a hedge against climate change/energy use. Environmental benefits include improved air quality and recharged groundwater. Economic benefits include job creation and increased property values. Social benefits include improved aesthetics and higher quality recreational amenities. Given its myriad of benefits, we hope to continue efforts to fund, leverage policies, effect partnerships, and provide educational outreach regarding green infrastructure in this region.

In addition to green infrastructure for stormwater management, our green approach to urban flood management strives to mimic nature to restore natural functions to stream corridors. One of the previous flood management approaches, dating back several decades, stripped the river banks of vegetation and lined channels with concrete to quickly move floodwaters out of neighborhoods. In addition to losing aquatic and riparian habitat and increasing the risk to public safety due to the fast-moving waters, the aesthetic appearance of rivers and creeks was severely degraded. Given the increase in storm intensities, development and floodflows in the past several decades, the concrete-lined channels were no longer able to achieve an acceptable level of flood protection to surrounding neighborhoods.

Since the 1990s, we have taken a more holistic approach to watercourses in the region, considering both flood management and the riparian habitat restoration. Concrete-lined channels are being replaced with vegetated floodplains and rock-lined channels with pools and riffles. Through this approach we achieve flood management goals while also improving water quality, natural habitat, and public safety throughout the system of stream corridors. The approach also restores the public's understanding of these urban waterways as valued social, economic and environmental resources.

REGIONAL GUIDANCE

One example of regional guidance ripe for development is a rain garden guide. To provide a fool-proof approach, MMSD can establish rain garden guidelines that clarify the benefits, provide expert advice on native plants specific to southeastern Wisconsin climate and soils, and avoid contributing to excess inflow/infiltration into sanitary sewer pipes. MMSD can innovate approaches on water reclamation facility property such as the South Shore Water Reclamation Facility, helping the facility to become a regenerative facility that not only reclaims water and harvests nutrients, but also heals the land and creates jobs.

AMENDING SOILS

Amending soils is an effective strategy for increasing capacity and treatment efficiency of green infrastructure systems. Soils can be amended by increasing organic matter, increasing worm populations that provide aeration, and replacing areas of native clay soil with engineered soils.

Adding organic matter can help to increase the rate at which water infiltrates the ground and can help to increase removal efficiency of stormwater pollutants. Organic matter can help to increase the infiltration rate of the Milwaukee region's native clay soils.

Worms can help to improve soil conditions for infiltration, especially in clay soils. The movement of worms (and other biological activity) helps increase soil permeability. Earthworms create burrows (macropores), and also increase the organic content of soil, decreasing soil density and helping to prevent the burrows from collapsing when the soil is saturated. The macropores act as channels for stormwater to infiltrate into the ground, allowing for subsurface movement of the water. Macropores act like straws drawing the stormwater into the intricate network of burrows that worms build, increasing the rate and amount of stormwater infiltration.

Aeration involves removing small soil plugs or cores from lawns to help restore porosity. As lawns age and are used, soil may compact, reducing pore spaces that allow water and air to infiltrate. Aeration can help restore these functions.

Replacing clay soils can help achieve greater infiltration, support specific or targeted vegetation and soil biota, and treat stormwater. It is more costly than the strategies mentioned above, but is sometimes necessary when high infiltration rates are needed in the short term.

Greenseams® Property

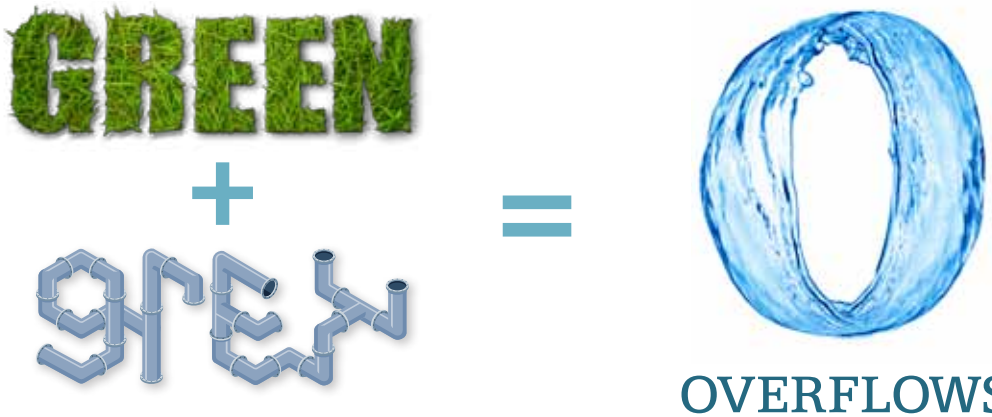
Greenseams®, a land acquisition program that helps prevent future flooding while supporting and protecting MMSD's structural flood management projects—infrastructure investments worth hundreds of millions of dollars—has been an instrumental part of our holistic approach to watershed management. The program permanently protects key lands that contain water-absorbing soils through voluntary purchases of undeveloped, privately owned properties in areas expected to have major growth in the next 20 years. Targeted properties tend to be along streams and shorelines and those with wetlands that may face development pressure. Protecting these lands from development protects the health of the watersheds and reduces the potential for future flooding. Intent on engaging the experts, we work with The Conservation Fund (TCF)—a national nonprofit organization—to run Greenseams®. To date, almost 2,300 acres encompassing 78 properties have been protected through the program.

In late 2009, MMSD released "Fresh Coast Green Solutions" (FCGS) to introduce green infrastructure strategies to the public on a broad scale and to show our commitment to green infrastructure as a complement to grey. FCGS lays out the expectation to achieve zero overflows by 2035 through the intensive use of green infrastructure in concert with our extensive grey infrastructure. Advocating for stormwater managers and the public to "think outside of the pipe," FCGS suggests and details 10 different green infrastructure strategies to manage stormwater and improve water quality.

What we can do...

For green infrastructure to be effective, implementation is needed on a large scale. For that, an overall plan is needed that integrates green infrastructure not only across private property, but also across public parks and open space throughout the region, the regional flood management program, and municipal stormwater systems. Our 2035 Vision provides long-term goals, and a current "portfolio standards" project will provide interim targets that may vary by location. Implementing this will require bold regional leadership, cooperation and changes to what's commonly conceived as "infrastructure."

Other support mechanisms for regional implementation may include regional guidance on local ordinances, standard specifications, policies, and laws that concern green infrastructure. Where local government is unable or unwilling to make changes, regional entities should be considered in new alliances. Partnerships with entities such as the M7 Water Council, SWWT and its members, and local universities should continue to be pursued, and mechanisms to share and export information should be exploited.



Growing Power Hoop Houses

The highly successful Greenseams® program can be expanded northward up the Milwaukee River watershed as markets allow. More closely matching program boundaries with watershed boundaries may provide benefits outlined in Chapter 5. Enhancements, like soil or vegetation restoration on future Greenseams® properties may be desirable, and then a percentage of annual Greenseams® funding could be pledged toward improving the rainwater storage capacity of properties.

As with other aspects of sustainability at MMSD, we know that innovation can play a strong role in implementing effective green infrastructure. Exploring new technologies may identify tools that stormwater managers can use. Programs that encourage amending soils, for instance, may be the perfect antidote to our region's clay soils. Urban agriculture, and its demand for water, provides a virtually unexplored opportunity for rainwater harvesting and reuse.

As mentioned previously we initiated and expanded a private property I/I program with municipalities in the region. Part of that work involves disconnecting foundation drains from the sanitary sewer system. When that happens, discharges of stormwater to lawns are likely to result. To help, rain gardens can infiltrate stormwater discharges from building foundation drains via sump pumps, infiltrating water year round and keeping the water from flowing over sidewalks in the winter. A rain garden may therefore complement the sump pump to lawn discharge, helping water to infiltrate into the ground and keeping stormwater out of the sewer system.

Another approach that might be taken by the private property I/I program is to disconnect roof downspouts that are sometimes directly connected to sewers, either combined or storm sewers. (Note: downspout connections to sanitary sewers are illegal and must be disconnected.) Once disconnected, roof downspouts may instead direct runoff into a rain barrel or cistern (with overflow to a rain garden). In addition, slowing the path of stormwater by capturing it in a container will slow its delivery to combined or storm sewers and, in doing so, potentially reduce stormwater infiltrating into these sewers.

Interest in urban agriculture—growing, distributing and consuming food close to where people live—is exploding in popularity in the Milwaukee region. Home to large innovators and small-scale producers alike, the world is beginning to look to Milwaukee for innovations not only in agriculture but also in aquaponics and related fields. Harvesting and using rainwater for this purpose is a natural solution, and we can provide leadership in seeking and implementing solutions. Through these efforts, we can collaborate with local groups and educate the public on the many uses of collected stormwater.

Pabst Brewery Redevelopment, Rain Garden Bioswale

What goals have we set...

Achieve zero sanitary sewer overflows, zero combined sewer overflows and zero basement backups to the extent feasible.

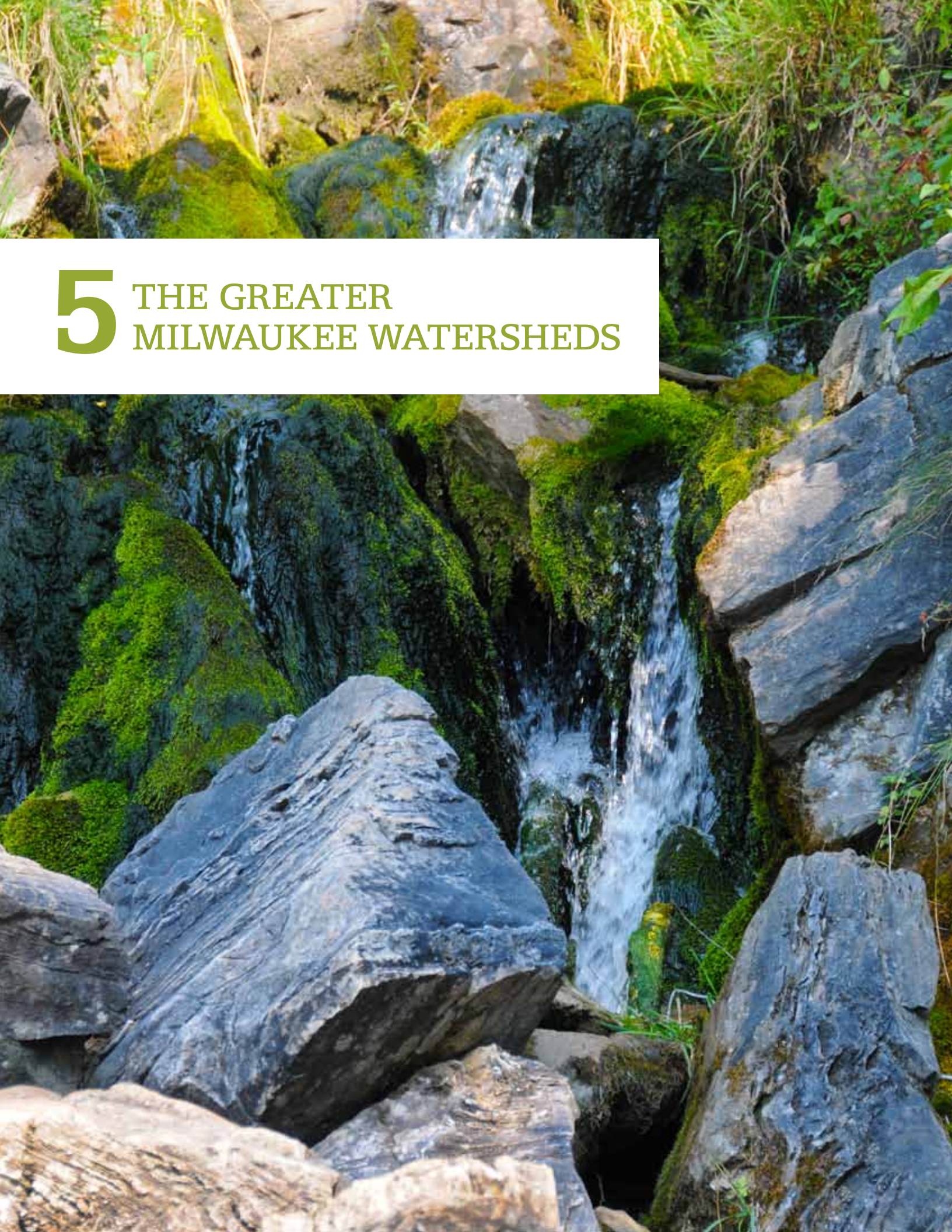
Next steps in this goal category include setting *measurable* goals in the following action areas:

- Develop and implement a plan—together with partners—that considers stormwater as a resource, integrating green infrastructure with MMSD's grey infrastructure, private (including I/I work) and municipal systems, parks/open space and flood management work. Codes, green streets and alleys, landscaping, ordinances, interim portfolio standards, standard specifications, and other opportunities for updates should be identified in the process.
- Fund research and development of new green infrastructure strategies (for instance, rainwater harvesting associated with urban agriculture that turns nuisance stormwater into a resource).
- Innovate new approaches and financial models to green infrastructure and export ideas beyond the region.

Work with MMSD's partners to achieve zero homes in the 1% probability floodplain.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- See goals in Chapter 5, "The Future of the Greater Milwaukee Watersheds."



5 THE GREATER MILWAUKEE WATERSHEDS

MMSD's mission is to cost effectively protect the quality of the region's water resources.

What's the connection to the Greater Milwaukee Watersheds?

While larger than MMSD's 411-square-mile planning area, watersheds naturally define the region within which we operate. Together with partners throughout the region, MMSD's efforts to protect the quality of the region's water resources have a direct and enduring impact on watershed health.

Kletzch Park Salmon Fishing

Why we care...

To meet regulations, to protect public health and the environment, and to sustain life, we know that protecting water quality is vital. For the most part, many of the region's surface waters generally are achieving water quality standards for most regulated pollutants. In addition, nonpoint source pollution (or polluted stormwater runoff) is the largest source of fecal coliform bacteria to the region's waterways and is the pollutant of primary concern. Nonpoint source pollutants degrade water quality, harming habitat and aquatic species populations and reducing the region's ability to fully enjoy its waterways. The Milwaukee area can achieve significant improvements to water quality through regional implementation of extensive measures to reduce pollution from stormwater.

Traditionally, MMSD has played a role in achieving water quality standards, not only by meeting our permit requirements, but also by providing leadership on watershed issues. Our 2020 Facilities Plan that was based on a watershed approach

Watershed-based Public Involvement

WHAT'S THE "WATERSHED APPROACH" TO PLANNING?

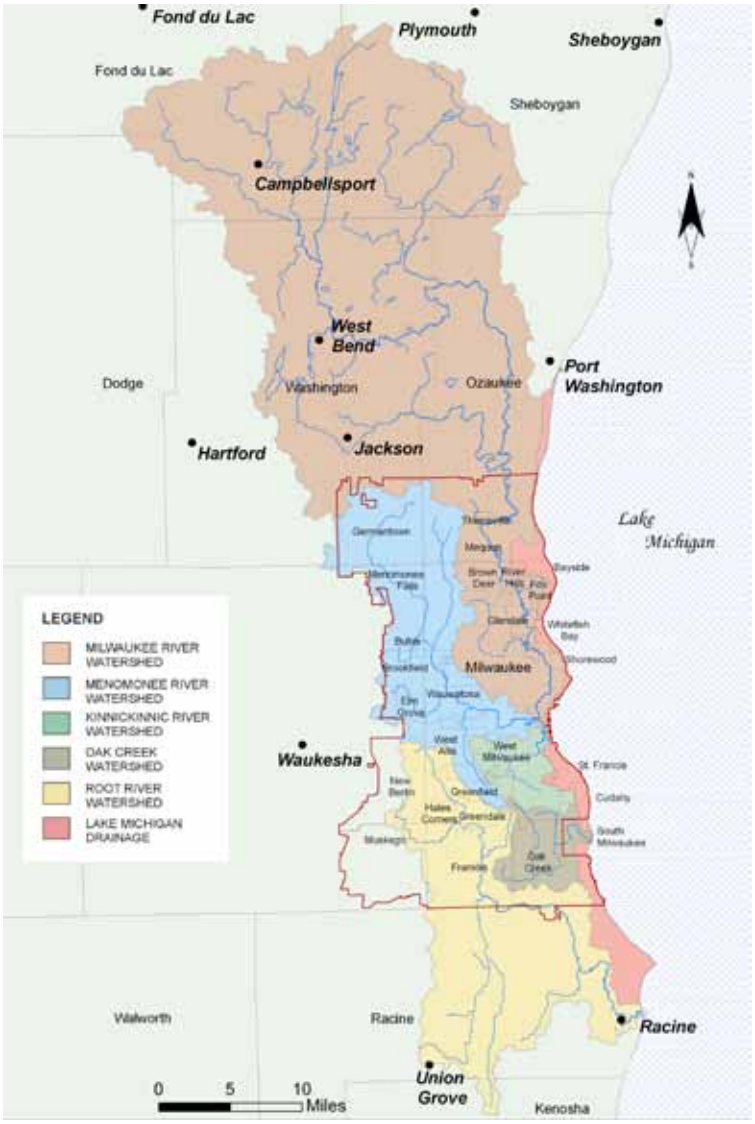
The watershed approach focuses on watershed boundaries rather than municipal boundaries, and is a significant step forward in good water resource planning practice. By looking beyond municipal limits, planners can consider water resource issues in a more cost-effective, balanced manner. The watershed approach also incorporates public involvement and decision-making based on strong science. If designed and executed properly, the approach can also help us link initiatives at the local, regional and state levels.

(see above) and the District's current involvement in a watershed-based permit for communities of the Menomonee River watershed are two examples of this.

MMSD's watershed-based approach also focuses on reducing nutrient pollution; this means helping to manage nonpoint source pollution from roads and the surface of the land as well as effluent levels from the water reclamation facilities. This is important because nutrients, such as phosphorus, may be a nuisance in water, causing algae blooms and low dissolved oxygen levels that don't support fish and other aquatic life. On land, however, phosphorus is an important but dwindling resource that fuels life and food for all (see page 36). Applying a watershed lens to nutrient management can provide far-ranging benefits to growing food and keeping water clean.

A watershed approach is important for water quantity issues, too. Since watersheds don't follow political boundaries, collaboration is needed between governmental and nongovernmental parties alike to ensure that upstream actions don't have downstream consequences. For nearly 10 years, MMSD has recognized that protecting upstream resources can enhance downstream environments. Our Greenseams® program does just that, purchasing land to ensure it continues to hold water where it falls. Green infrastructure like this, whether for stormwater or flood prevention purposes, provides many secondary benefits within watersheds such as nutrient management, improved habitat and riparian aesthetics.

Wet weather presents special challenges for MMSD and municipal sewer systems. In extreme events that bring lots of rain, rainwater can overwhelm the sanitary



Greater Milwaukee Watersheds

sewer systems and lead to sewer overflows and basement backups. We know that upstream water and flood management systems (like rivers and open spaces) that work *with nature* work best. In fact, impervious land cover is directly related to larger volumes of stormwater runoff, pollutant loads and overflows to area waterways.

What we can do...

MMSD was a founding member of and continues to be active in the Southeastern Wisconsin Watersheds Trust (SWWT), Inc. SWWT is a unique partnership established in 2008 to achieve healthy and sustainable water resources throughout the 1,100-square-mile Greater Milwaukee Watersheds through coordinated, collaborative efforts. SWWT's members include independent units of government, special purpose districts, nonprofit organizations, local residents and representatives of business and academia, all sharing common goals for the region's shared watersheds. Their purpose is to achieve significant improvements in water quality, aesthetics, and habitat in the Greater Milwaukee Watersheds, moving the region forward toward the primary goals of the Clean Water Act: fishable, swimmable waters.

Going forward, MMSD can support efforts to implement Watershed Restoration Plans (WRPs)* co-authored together with SWWT and the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and to partner on innovative approaches and projects—like watershed-based permits *(see box below)* and other regional mechanisms, river restorations, and green infrastructure strategies throughout the

SOUTHEASTERN WISCONSIN WATERSHEDS TRUST, INC.

Menomonee River

* Watershed Restoration Plans (WRPs) are consistent with the Update to the Regional Water Quality Management Plan prepared by SEWRPC (2008). WRPs for the Menomonee and Kinnickinnic rivers can be found here: http://www.swwtwater.org/home/publications.cfm (accessed September 21, 2011).

A Watershed-based Permit (WBP) is an innovative geography-based approach to stormwater, industrial, and construction site discharge permitting. WBPs extend to the natural boundaries of watersheds rather than being confined to political jurisdictions or industries. WBP conditions and expected outcomes are designed to meet core program requirements while tailoring management measures to the needs and characteristics of specific watersheds. A WBP approach can mature with subsequent permit cycles, initially applying to Municipal Separate Storm Sewer Systems (MS4) for polluted stormwater runoff and with time encompassing additional sources of pollution to receiving waters.

Whitnall Park

Yellow Cone Flower in a Greenseams® Prairie Restoration

region's watersheds. WRPs provide specific action recommendations that can be implemented in the near term to improve water quality within the Menomonee and Kinnickinnic River watersheds, with general action recommendations that can be implemented in the longer term. MMSD should support SWWT as a regional model that will continue to foster regional collaboration on water resource goals through the foreseeable future, and help lead future efforts to extend specific action recommendations in WRPs beyond 2015.

Our Greenseams® program, through time, can more fully adopt the watershed approach by extending up the Milwaukee River watershed. While Greenseams® acquisitions in such a large watershed beyond MMSD's planning area will have little impact on flood management unless undertaken on a grand scale, strategic acquisitions targeted for sites with high pollutant loadings to the river may have a significant impact on receiving water quality. Further, this could make such acquisitions ripe for water quality trading—particularly phosphorus—in the future.

The role of innovation in this and subsequent chapters cannot be overstated. MMSD and entities throughout the region should continue to support research initiatives and projects that provide solutions to current and emerging problems. In addition, new technology innovations will help to ensure a more sustainable and energy-efficient future that produces little to no waste (see Chapter 8). Strong program funding for research and development may also have a positive impact on jobs.

PHOSPHORUS

Agricultural mass production that grows much of the food we eat is impossible without phosphate fertilizers, and most of these fertilizers are from mined sources. Remaining global supplies of these mined sources vary, with projections ranging from 50 to 100 years. "Peak phosphorus," or the maximum global production rate for phosphorus, could occur as early as 2030, but the predictions vary widely.

The phosphorus cycle on earth is "open," with nutrients lost (i.e. dispersed) after they're used. This is important because phosphorus is a vital nutrient for growing food. Further, just five countries control about 90 percent of the world's remaining phosphate rock reserves. Managing phosphorus on a watershed basis may become a critical issue in the future.

MMSD Interactive Exhibit at Discovery World

Pelagos Boat, MMSD's Water Quality Monitoring Educational Tour

We can help cultivate interest in the region's water resources through an active public education program. If undertaken with others, these efforts can lead to positive changes in the public's water resource behaviors. Positive water behaviors, like reducing water use during big storms and using green infrastructure to manage stormwater, can incrementally improve the region's water resources. On a watershed-wide basis, the public can and will make a difference. Public education plays a vital role in the social, economic and environmental health of the watersheds.

What goals have we set...

Focus water resource management on watershed boundaries to better achieve water quality standards.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Continue to support and help implement watershed-based permitting in the region.
- Consider the expansion of Greenseams®, particularly when/if the potential for water quality trading becomes viable (e.g., 10,000 acres of river buffers to be purchased from 2011-2035).

Reduce sources of water pollution, including stormwater runoff.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Support partners implementing the recommendations of Watershed Restoration Plans of the Menomonee and Kinnickinnic River watersheds.
- Follow and remain involved in emerging concerns such as pathogens, nutrients, pharmaceuticals, personal care products, hazardous wastes, etc.
- Consider expanded forms of regional collaboration that best address issues across watersheds.

6 MMSD'S ENERGY USAGE

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our energy usage?

Our energy usage—*at the water reclamation facilities and at support facilities*—is a significant percentage of our annual budget (expected to be about 18% in 2012). Minimizing the amount of energy MMSD purchases through energy conservation and use of home-grown renewables helps cost-effectively carry out our mission.

Why we care

MMSD knows it's important to continue to minimize energy use and switch to domestic, secure forms of energy. Doing so can save money, reduce price volatility, reduce greenhouse gas emissions, and provide energy security. In the context of supply and demand, energy conservation (i.e., demand) and renewable energy (i.e., supply) are things over which we have some control.

- **Demand:** To save money, MMSD continually seeks new operational strategies and system optimization. As new technologies are available and systems become outdated, replacement technologies can further reduce energy consumption. About 18% of our proposed expenditures in 2012 are for energy and energy-related expenditures. Energy is a significant monetary expense to our ratepayers, and it's also a significant expense to the environment.

- **Supply:** Renewable energy—energy from naturally replenished sources—can be harvested on small and large scales. As a resource, wastewater contains and can generate many forms of renewable energy, both in terms of what's in it and from its movement. For instance, fuel cells can emit light energy that degrades organic compounds in wastewater, generating electrons that provide a renewable source of electrical power. Biosolids in wastewater can be anaerobically digested to make biogas. And, algae can be grown in nutrient-rich wastewater and harvested to make biofuel. Wastewater's thermal energy can be harvested and used for district heating and cooling. Its gravity-driven movement can turn propellers and turbines.

PEAK OIL

Peak oil refers to the peak in oil production on this planet. Oil is responsible for tremendous economic and population growth, but unfortunately it is a finite resource going forward. On this planet, we extract and refine about 90 million barrels/day, with demand growing every year. The "peak" in oil production could mean the end of relatively inexpensive oil because the easiest oil to extract first is less expensive. Facilities that are dependent on oil may see price spikes after peak oil is reached—a point in time over which there is some debate. Sound planning to reduce fossil fuel use and to rely instead on renewable sources of energy can help alleviate the concerns and costs!

Renewable energy can reduce our dependence on foreign supplies, reducing our need for non-renewable fossil fuels and creating more secure sources. That, in turn, can reduce price volatility (and potentially price itself). Volatility is affected both by the demand and supply sides of the equation. Moving forward, that means MMSD can respond to so-called "peak oil" by both addressing demand and supply to minimize price via renewable energy.

Landfill Gas Pipeline

The connection between energy and water is particularly important. Simply put, processing less water can result in using less energy. Nationally, water reclamation facilities spend about $4 billion annually for energy. Likewise, the production of electricity from fossil fuels and nuclear energy requires 190,000 million gallons of water per day, accounting for 39% of all freshwater withdrawals nationwide. More water use means more energy use, and vice versa.

Beyond theory is MMSD reality. Not only do we successfully operate two water reclamation facilities, but in reclaiming water from "waste" we also seek to conserve and generate energy in the process. Home-grown energy meets two-thirds of the South Shore Water Reclamation Facility's (SSWRF) electrical needs. The Jones Island Water Reclamation Facility (JIWRF) hosts a 20 kw solar installation that meets a small percentage of that facility's needs as well. We are constructing a 19-mile landfill gas pipeline that, when on line in 2013, will include new turbines powered by landfill gas to meet a significant share of the JIWRF electrical needs.

South Shore Water Reclamation Facility Digester Gas Storage Spheres

MMSD & RENEWABLE ENERGY TODAY

At MMSD, we anaerobically digest biosolids to produce biogas at the South Shore Water Reclamation Facility (SSWRF). We are working now to improve biogas digester mixing to increase biogas production. We are also working to attract additional sources of high strength waste (HSW) to boost biogas production. Through these efforts, we will initially become self-sustaining and in the long term we may become a net power exporter!

MMSD makes energy-efficient choices whenever opportunities present themselves. For the Headquarters and Lab buildings, our Facilities Department uses the Leadership in Energy and Environmental Design (LEED) for Existing Buildings Standard as the compass for decisions on purchasing, maintenance activities, and operational changes that can save energy. Energy usage and water consumption are measured and tracked as well.

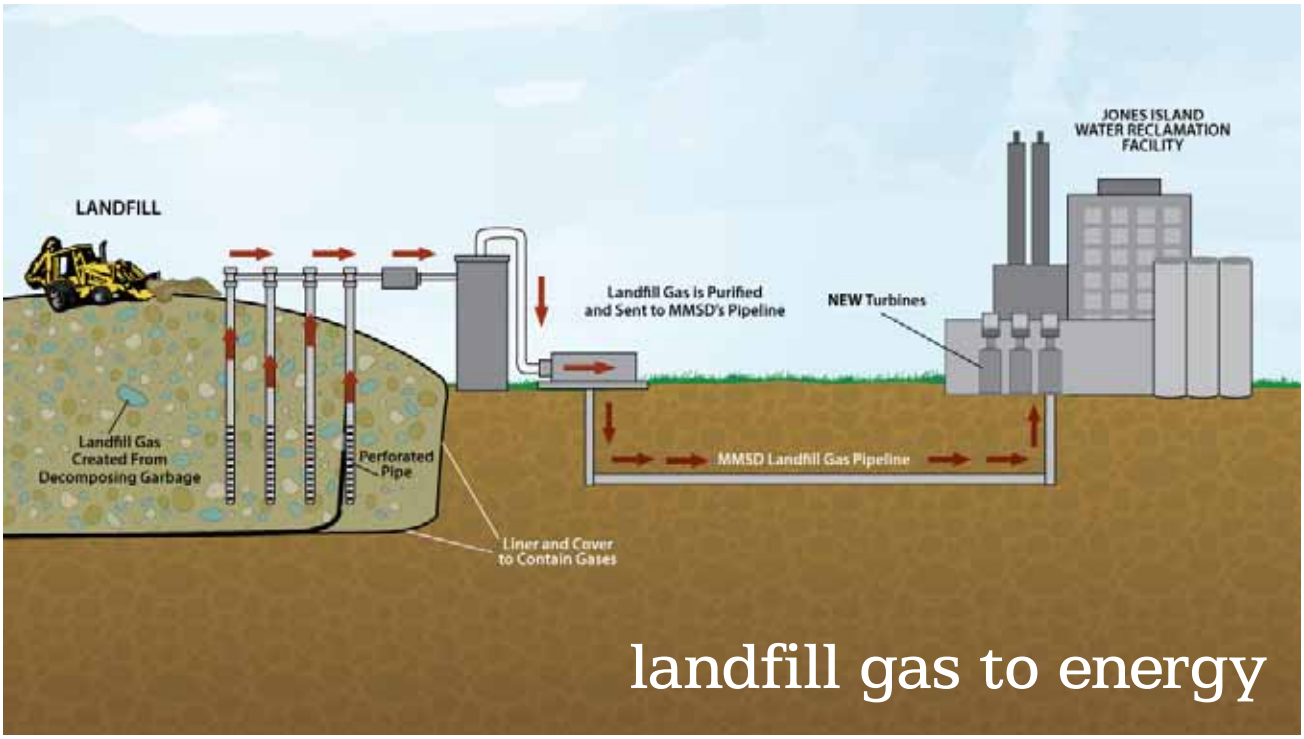
Our recent vehicle procurements included advanced and alternative fuel vehicles. As a result, MMSD now has more than a dozen compressed natural gas, hybrid, and electric powered vehicles. In addition, we recently trained field staff in "eco-driving" techniques that reduce fuel use. Over the first year of the program, these combined efforts have saved us $4,000.

MMSD Natural Gas Vehicle Fueling

What we can do...

There are a number of ways MMSD can continue to work with its private operator, Veolia Water Milwaukee (Veolia), to conserve energy. For instance, the process air compressors that aerate activated sludge are the largest electric power users at both of MMSD's two reclamation facilities. Aeration projects to be pursued at both WRFs will reduce future energy usage.

In addition, larger pumping systems consume significant amounts of energy, and could benefit from optimization studies. Lighting audits can further identify potential efficiencies at the plants. In general, energy conservation opportunities will continue to be explored whenever equipment replacement is considered.



landfill gas to energy

ALGAE

Algae can be cultivated, harvested and refined as a biofuel. To grow, it needs sunlight, water and nutrients. What better place to supply "free" nutrients than at water reclamation facilities? As biofuels research matures, MMSD hopes to become more involved in research efforts of others. Using wastewater to grow algae and create biofuels not only reduces waste by treating it as a resource, but could also help us meet our permit limits on nutrients for generations to come. This is a game-changing strategy!

There are a number of ways MMSD can work with Veolia to continue to develop existing and new sources of renewable energy. For instance, turbine waste heat represents more than 75 percent of all energy sources at JIWRF. While we try to use all the waste heat generated in the solids drying process and the JIWRF boiler system, there are many times when all waste heat can't be used. MMSD will evaluate ways to use all the waste heat generated by the new landfill gas-powered turbines. Similarly, MMSD will continue to pursue new sources of high-strength waste as well as the mixing and staging of waste at SSWRF to help supplement our energy needs. MMSD is also seeking to eliminate the need to flare off excess gas at SSWRF by investigating gas storage and alternative uses (such as in fleet vehicles). Other renewable energy sources, including wind (particularly at SSWRF where unused land is ample), solar (both PV and hot water, particularly at the headquarters building and an expansion on the drying and dewatering building at the JIWRF), sewer-thermal, and algae biofuels will be explored as opportunities arise.

Through a combination of conservation and renewable energy, it is possible that MMSD could become a net energy producer. A wastewater plant in Strass, Austria has accomplished this. There are technical and legal challenges associated with doing this, but we hope to achieve (net) energy neutrality by the year 2035!

For vehicle procurements, we will continue to consider and purchase advanced and alternative fuel vehicles. As technologies improve, these vehicles are expected to become increasingly price-competitive with fossil fuel vehicles. Virtual substitutes for physical travel will also be considered, including more remote data gathering, telecommuting and virtual meetings.

What goals have we set...

Conserve energy through all capital projects.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Consider energy efficiency in all projects and operating procedures during normal cycles of evaluation and replacement.
- Consider new decision-making tools and smart grid technologies.

Seek renewable energy sources to meet energy needs.

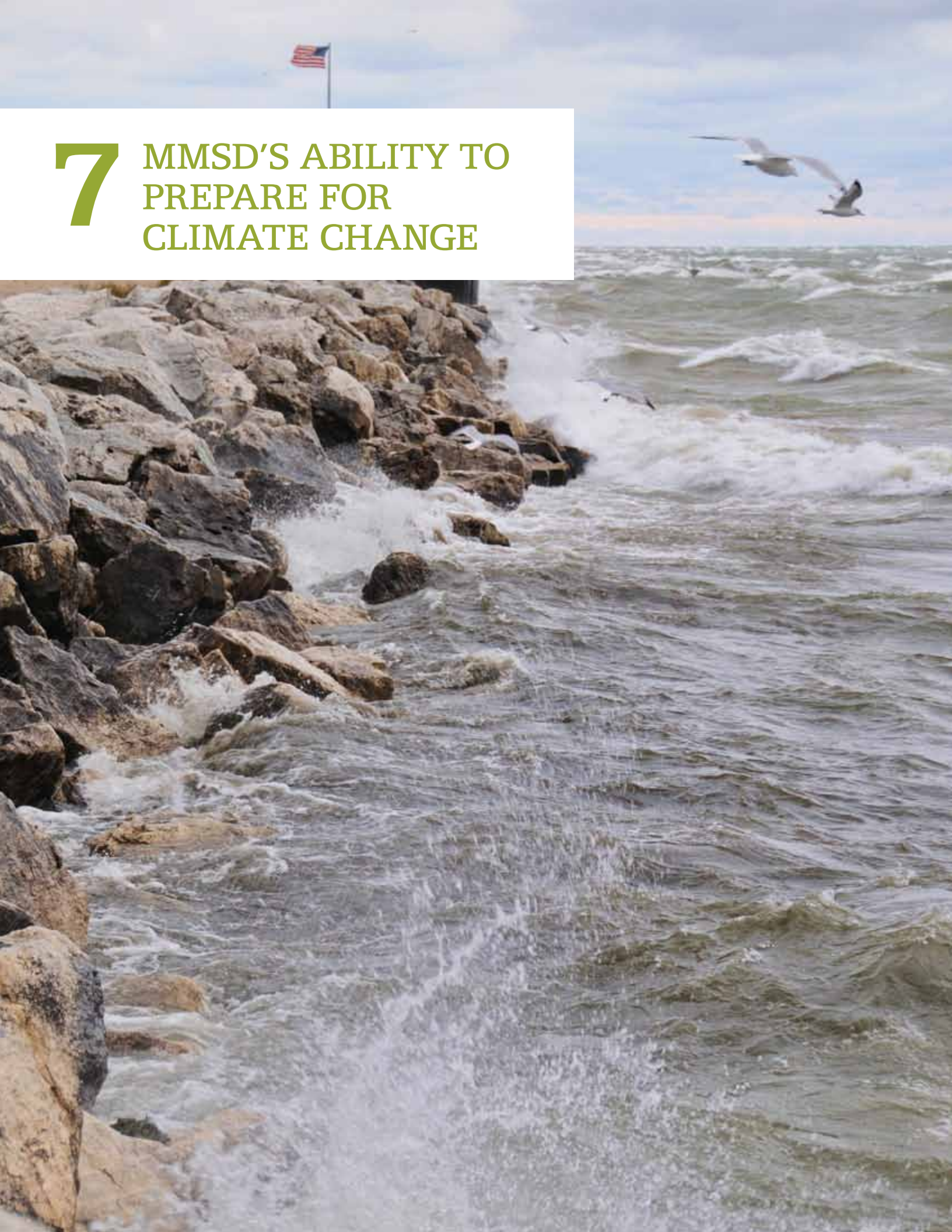
Next steps in this goal category include setting *measurable* goals in the following action areas:

- Consider and implement efficiencies and enhancements in existing renewable energy projects.
- Consider new sources of renewable energy, prioritize by cost-effectiveness and implement.
- Procure advanced and alternative fuel vehicles when needed, and consider alternatives to the need for physical transport.
- Consider ways to support innovation in the field, prioritize recommendations and support implementation.

SEWER-THERMAL ENERGY

Sewer-thermal energy refers to the energy in wastewater that can be harvested using heat-exchange technology. Even in winter, wastewater contains significant energy in the form of heat, and with heat exchangers placed directly in sewers that energy can be harvested and used by adjacent land uses. That energy can also be harvested and used at the water reclamation facilities where it has the added benefit of reducing the temperature of cleaned water when it's returned to Lake Michigan.

7 MMSD'S ABILITY TO PREPARE FOR CLIMATE CHANGE



MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our ability to prepare for climate change?

Our ability to prepare for climate change—*particularly the increasingly severe storms experienced in southeastern Wisconsin*—helps us meet the challenge of managing the effects of increasing stormwater volumes that leak or are piped into sanitary and combined sewers. It also helps us reduce emissions caused by expensive and price-volatile fossil fuel consumption, saving our ratepayers money.

Why we care...

Climate change manifests itself in many ways in the Greater Milwaukee Watersheds. Thanks to the dozens of experts involved in the Wisconsin Initiative on Climate Change Impacts (WICCI), Wisconsin residents have projections of the change that may come based on over 60 years of temperature and precipitation data. Here are some of WICCI's findings about this region based on statistical and dynamical modeling:

- **Temperature:** WICCI reports that by the middle of the century statewide annual average temperatures are likely to warm by four to nine degrees Fahrenheit, with wintertime average increases even higher.
- **Precipitation:** WICCI reports that the state is likely to continue to have more precipitation, and that during fall and spring the frequency of large storms will increase. In addition, more wintertime precipitation may fall as rain.

- **Secondary effects:** In addition to temperature and precipitation, secondary effects of the changes noted by WICCI may affect the quantity and quality of water resources, natural habitats, agriculture, soil erosion, coastal regions, and human society and the built environment. Specific water resource impacts in lakes may include increased sedimentation and nutrient loading, changes in ice cover, physical changes to lakes, changing lake levels and changes in flora and fauna. Water resource impacts in rivers and streams may include changes in baseflow, polluted runoff, fish habitat, flooding and land use.

WICCI's Stormwater Working Group says it's premature to make significant changes in the design of stormwater infrastructure just yet except where change is warranted by today's climate.

Responses by governments like us that may plan for these changes include:

- **Mitigation:** Through mitigation, the idea is to reduce or eliminate the risks and hazards to climate change. The International Panel on Climate Change (IPCC) further defines it as intervention that either reduces the sources of greenhouse gas emissions or enhances greenhouse gas "sinks." Sinks accumulate and store carbon indefinitely, and include things like absorption of carbon dioxide by the oceans and photosynthesis by plants.

- **Adaptation:** Through adaptation, the idea is to adjust to changes that may be inevitable, thereby moderating their effects or coping with their consequences (or benefits). The IPCC identifies various types of adaptation strategies including anticipatory and reactive adaptation, private and public adaptation and autonomous and planned adaptation. At its core, adaptation is good risk management. As a result, MMSD can create an overall internal risk analysis process that characterizes near-, mid- and long-term actions necessary to protect our existing investments in facilities and create new facilities, programs, and operational improvements that adapt to the wet weather impacts of climate change.

What we can do...

- **Mitigation:** The increasingly severe storms that have been documented in southeastern Wisconsin over the last decade may be due to accelerated climate change. It is impossible to know if this trend will continue, but at MMSD we can play a part in reducing our carbon footprint and our potential impact on climate change. To do that, we can continue to reduce our fossil fuel emissions and provide "carbon sinks."

- A recent carbon footprint study for our facilities is currently being updated in a number of ways. Among them, the current work will update the 2000-2007 footprint through 2012 and develop a greenhouse gas emissions and energy calculation tool and scenario planning tools to track progress toward achieving goals outlined in our 2035 Vision. Once developed, the calculation and scenario planning tools will be used as directed, and recommendations from the study will be considered and implemented as warranted.

Milwaukee Skyline

- In addition to this work, we are also helping to fund work to downscale climate data models and forecast the changing climate's potential regional impacts to combined and sanitary sewer overflows. This work will help create and support a robust southeast Wisconsin regional climate change modeling program that will help forecast climate change impacts. Once this report is released, we plan to use the findings to influence design criteria and operational strategies.

- Also, we will consider the larger sources of carbon emissions found in the carbon footprint study—particularly biogas—and capture it at the process level for another use. This could be done at the water reclamation facilities or upstream in the conveyance system. In the conveyance system, for instance, biogas could theoretically be used to power street lights. This is done now in parts of England and Canada. (In colder climates, a small burner may be needed to ensure that condensation doesn't form ice in the gas supply line.)

- To provide carbon sinks, there are also a number of steps MMSD has taken and will continue to take. Our Greenseams® program is an innovative flood prevention program that permanently protects key lands containing water-absorbing soils (see Chapter 5). With nearly 2,300 acres acquired to date, Greenseams® properties can and will be enhanced to store even more carbon than they currently store.

CLIMATE CHANGE

The earth's climate has always changed. Science tells us that the earth's climate is now changing much more rapidly than ever before.

In the past, climate change was caused by natural factors such as volcanic eruptions, changes in the Earth's orbit, and changes in how much energy is released from the sun according to the U.S. Environmental Protection Agency. For most of human history, the Earth's atmosphere contained about 275 parts per million of carbon dioxide.

More recently, the Earth's atmosphere has been found to contain about 390 parts per million of carbon dioxide...and that number is rising by about 2 parts per million each year.

Most scientists (97%) agree that our carbon emissions are likely influencing the Earth's climate. This influence affects the earth's rainfall patterns, temperature, plant and animal populations, and more! In an urban environment, these changes can be magnified because of dense development and more complex infrastructure.

- MMSD also has a Regional Green Roof Initiative that implements green roofs on buildings that are sources of runoff into the combined and—when pipes leak—sanitary sewer system. Green roof plants also act as carbon sinks, taking in carbon from the atmosphere and using it for energy to grow.

- **Adaptation:** To handle large storms, MMSD will continue helping to control stormwater that gets into sanitary and combined sewer systems. Rising temperatures will have implications for snow vs. rain in the winter, and we will plan for any operational changes that might be needed when the time is right. In addition to operations, solutions to handle increasingly severe storms may include capacity enhancements (both grey conveyance and green infrastructure source management) and private property inflow and infiltration (I/I) fixes. We will make changes in design strategies in the future to address the effects of climate change and the effect that the associated changes may have on our conveyance, storage and reclamation facilities.

- To moderate the effects of climate change—particularly rainfall intensity and its impact on our capacity to store, convey and treat wastewater—there are a number of steps MMSD has taken and will continue to take. For instance, we encourage green infrastructure on public and private property alike to augment existing storage capacity, keeping stormwater out of combined and (leaky) separate sanitary sewers when it rains (see Chapter 3). Expanding green infrastructure can help us prepare for climate change and make the region more resilient in the face of intense storms.

Capital projects that replace aging infrastructure or provide new conveyance pipes can be sized based on rainfall data that includes recent severe storms. As a result of our 2010 Facilities Plan recommendations, most conveyance system bottlenecks have already been addressed. The situation with new rainfall data will continue to be monitored.

Treatment capacity can be increased once population projections are attained, specifically at the SSWRF as per the 2020 Facilities Plan recommendations. This is because space is

MMSD's approach to preparing for CLIMATE CHANGE

MITIGATION Reduce carbon emissions & provide carbon "sinks"

PAST

Renewable Energy
anaerobic digestion, solar

Green Infrastructure
demonstrations

Carbon Footprint
(2000-2007)

PRESENT

Renewable Energy
landfill gas

Green Infrastructure
widespread green roofs

Carbon Footprint
targets, modeling, tracking, reporting
Greenseams®

FUTURE

Renewable Energy
anaerobic digestion, solar, wind

Green Infrastructure
widespread across the region

Carbon Footprint
significant reduction
Greenseams® expansion

ADAPTATION Anticipate changes to come & moderate effects

PAST

Climate Change
participate in WI Initiative on Climate Change Impacts

Green Infrastructure
demonstrations

Infastructure Design
design based on history

PRESENT

Climate Change
participate in WI Initiative on Climate Change Impacts

Green Infrastructure
widespread green roofs

Infastructure Design
design based on history

FUTURE

Climate Change
expand modeling to look beyond CSO impacts

Green Infrastructure
widespread across the region

Infastructure Design
design based on history & future modeling

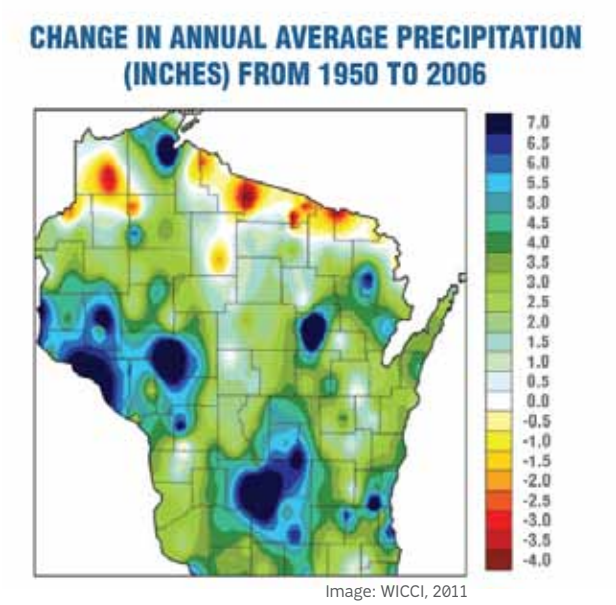


Image: WICCI, 2011

available at SSWRF. A process enhancement demonstration is ongoing there now. Because of high costs, conveyance considerations, and the level of protection for sanitary sewer overflows (SSOs), expanding capacity at JIWRF is not recommended at this time. Additional capacity could also be considered at remote SSO sites and at the harbor siphon in the future, provided removal of solids and biological treatment are feasible.

As mentioned earlier, green infrastructure can provide additional capacity to supplement the current capacity in the fixed grey infrastructure system. It can do this by holding and infiltrating stormwater where it falls, reducing runoff and filtering pollutants. Our strong support of green infrastructure as a way to prepare for climate change can help educate public and private-sector landowners alike about how to manage the increasingly severe storms. We have received millions of dollars in grant funding to support our Greenseams® land acquisition program. We have spent millions of dollars on a Stormwater Best Management Practices Partnership Program and a Regional Green Roofs Initiative that, together, have implemented projects able to hold hundreds of thousands of gallons of stormwater every time it rains.

What goals have we set...

Mitigate the impacts of a changing climate.

Next steps in this goal category include setting *measurable* goals in the following action areas:

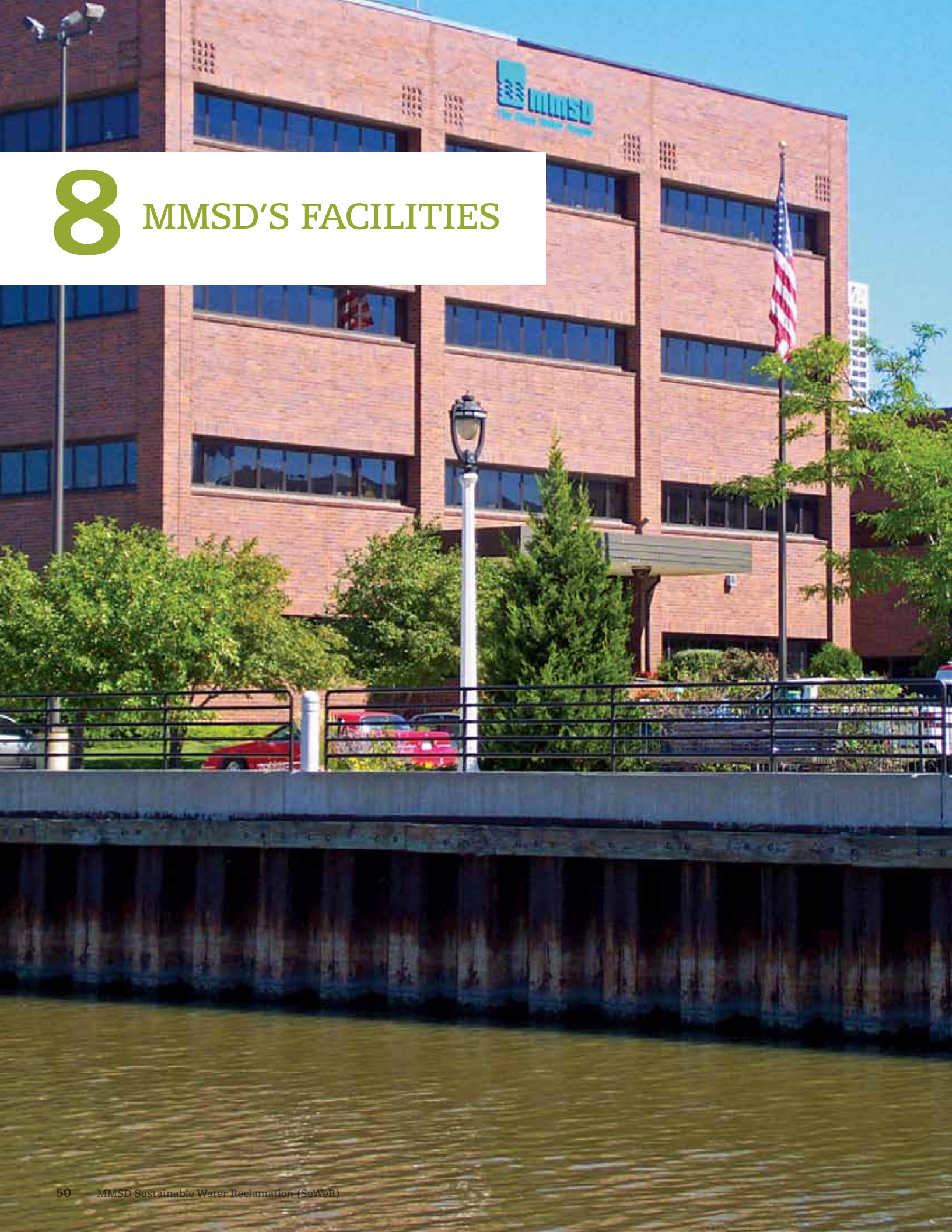
Follow recommendations outlined in MMSD's carbon footprint study, as amended, toward the goal of reducing greenhouse gas emissions by 90 percent from their 2000 baseline, including:

- Recommendations to reduce MMSD's carbon footprint.
- Recommendations to enhance the capacity of MMSD's Greenseams® program to act as a carbon sink.

Adapt to the impacts of a changing climate.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Consider the impact of downscaled climate models and revised MMSD system models on future design standards, and make changes to design standards as warranted.
- Implement recommendations in the grey and green infrastructure chapters of this plan.
- Conduct an integrated climate change planning process with the region.



8 MMSD'S FACILITIES

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our facilities?

Our facilities and the waste they generate can be reconceived as regenerative facilities that treat waste as a renewable, valuable resource. Doing this saves money and better protects the region's water resources.

Why we care...

MMSD conveys, stores and treats wastewater, and has done so for about 85 years. To date, our facilities have been successfully built and maintained around these needs. As needed, new technologies and processes have been adopted not only to meet permit requirements but also to protect public health and the environment. We excel at this, treating more than 98 percent of the wastewater sent to us since the Deep Tunnel went on line. To get the job done, a number of ancillary facilities are required, such as our headquarters and lab buildings, our water quality protection team's offices at S. 13th Street, our pump stations and construction sites, and miscellaneous other facilities. Our facilities are not immune to time and are aging. Operations and maintenance (O&M) are critical, but so too is replacing facilities when they reach the end of their useful lives.

At MMSD we systematically address facility needs through our Asset Management Program that includes our vision, organization, and planning for an asset management plan. Through this program, we identify and track immediate, near-term and long-term actions we need to take to maintain proper function of our assets that provide conveyance, storage and treatment of wastewater and conveyance and storage of stormwater runoff. Our program covers many aspects of our assets including knowledge, planning, refurbishment and replacement, development, operation

Stormwater Pollution Prevention Plans (SWPPP) are plans that identify structural and non-structural controls to minimize potentially negative effects of stormwater discharges. Collectively, a site's stormwater controls are designed to minimize erosion and runoff of pollutants. They include using things like green infrastructure and stormwater inlet filters as well as rerouting stormwater on an industrial site so pollutants aren't carried into area waterways.

Columbia St. Marys Green Roof

and maintenance, condition monitoring, financing and financial reporting of assets. Through good asset management planning, we have shifted from reactive project planning to planned reinvestment in our capital assets. It also opens the door to anticipatory design at MMSD—design with an innovative look toward the future—to allow flexible uses, newer and better techniques, and more efficient equipment.

At MMSD, we also routinely find ways to reduce the amount of waste that comes from our projects and operations. We have made great strides to reduce waste through value-added products like Milorganite®, through various waste reduction efforts that recycle our products and purchase products with recycled content, and the use of waste heat at water reclamation facilities. We continue to strive for improvements in reducing, recycling, and reusing our waste.

Similarly, our lab uses chemicals, and that use is currently unavoidable to meet our water quality testing needs. For instance, to ensure the most accurate results from our laboratory tests, we must use sterile equipment. The lab continues to seek ways to avoid using chemicals that can have a negative impact on the environment, reducing overall use and replacing use with more inert substances whenever possible. Reducing our waste, energy use (see Chapter 6), and the use of chemicals at our facilities continues to increase our overall efficiency and save money.

Stormwater Pollution Prevention Plans (SWPPPs) for our facilities help to reduce MMSD's pollution "footprint" and reaffirm our commitment to truly clean water. MMSD is required to have SWPPPs for both JIWRF and SSWRF, but we go a step further and have SWPPPs in place for three additional facilities that are not required. We do this to lead by example; on-site stormwater management is important to downstream receiving water quality!

Fats, oils and grease (or FOG) in solid form can cause blockages in sewers that can, in turn, lead to overflows to area waterways. In liquid form, FOG floats to the top and can be collected at water reclamation facilities. MMSD currently landfills the FOG it collects, but recognizes this could be a potential source of energy perhaps if fed to the digesters and anaerobically digested. Other beneficial uses may be possible as well, and we are working with municipalities and researchers to develop FOG programs.

What we can do...

An on-going commitment to operational and technological innovation is key to providing reliability while also positioning MMSD for the future. This can be accomplished through any number of ways mentioned in the next chapter. It can also be accomplished through innovative approaches, such as finding multi-purpose uses for existing facilities and considering service consolidation where economies of scale might prove effective.

Reusing waste—whether at our reclamation facilities or at ancillary installations—and treating it as a resource is part of our history and key to our future. It requires continuously re-thinking waste and fine-tuning our approach so that waste continues to be a biological or technical nutrient for other processes and products. Going beyond what we currently do now will require fine-tuning our audit to identify current and future waste streams, the sources and flexibility of these wastes, and beneficial reuses in our ever-changing world.

REGENERATIVE DESIGN

Regenerative design or regenerative sustainability is about restoring energy and materials to create sustainable systems that integrate the needs of society with the integrity of nature. Regenerative design systems are holistic frameworks, in closed cycles, that produce no waste.

SUPPLY CHAIN

A supply chain is a system that's involved in moving a product or resource from suppliers to consumers. It can involve things like people, equipment, and resources, and it can span the entire life cycle of a product. A "green" supply chain is one where more green or sustainable ways of doing things are used. The environmental impacts of each life cycle stage are considered and, where possible, reduced in a green supply chain.

Our lab continues to look for opportunities to reduce chemical use and searches for replacements for chemicals considered to be harmful in the environment. For all materials we purchase, we should continue to consider the green supply chain. Doing so is consistent with our sustainable purchasing policies for products and services.

In light of continuing efforts to reduce waste and a growing awareness that waste need not be wasted (such as in the case of phosphorus), zero waste (or at least zero net waste) is a distinct possibility for MMSD in the future. Since waste is a sign of inefficiency, zero waste should save money. For instance, reusing FOG collected at the water reclamation facilities, either on-site or for a recycled use, will be considered in order to reduce waste volumes. Regardless, zero waste provides a visionary endpoint that can lead to greater innovation. Zero waste supports overall sustainability.

SSWRF—a facility already meeting two-thirds of its electrical needs from biogas—is well-positioned to be redefined as a regenerative facility. The site provides space that's used now by others to compost food waste and to grow food by Growing Power, Inc., and ample opportunities for other regenerative activities abound. For instance, mowed areas will be converted to native vegetation, and that vegetation will provide habitat for nesting birds along the shoreline flyway. Rain garden plants would even be grown as part of MMSD's new Fresh Coast Jobs Initiative training program and ultimately the rain garden plants can be harvested and then planted in rain gardens throughout the region. In this way, MMSD can help sow the seeds of regeneration throughout the region.

MMSD's operator, Veolia Water Milwaukee, last year developed a Water Impact Index. The index goes beyond a simple footprint; in fact, it's the first indicator that enables a comprehensive assessment of the impact of human activity on water resources. It also accounts for the intertwining of water and carbon, and expands far beyond existing volume-based water footprint tools by incorporating multiple factors. We can apply this on major projects for enhanced decision-making.

Beyond our conveyance system and water reclamation facilities, our watercourse efforts manage out-of-bank flooding. For several years, MMSD has been removing concrete channels to return streams to a more natural condition. In some cases this helps to reduce pollutant loads to area streams and Lake Michigan. Continuing current efforts will improve the health of our rivers and streams by allowing vegetation to grow, providing habitat for fish and other animals, and capturing and filtering pollutants from the estuary and Lake. Deconstructing homes (demolition plus recycling and up-cycling—the process of converting waste materials or useless products into new materials or products of better quality or a higher environmental value) in flood management project areas should also be encouraged where there is recognized value in salvaging and/or recycling various building materials vs. landfilling this material.

What goals have we set...

Pursue sustainable practices and facility upgrades that support future needs.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Develop an innovation team and schedule, and meet regularly to brainstorm new approaches to facilities and facilities "waste." Conduct a waste audit and identify steps on the path to a potential zero waste goal.
- Develop a formal lab sustainability program and implement it.
- Formally consider how Veolia's Water Impact Index might be applied as a standard operating procedure to project or program evaluation.
- Consider a formal policy that continues to integrate sustainability principles into watercourse projects.
- Develop a formal plan to convert the South Shore Water Reclamation Facility into a Center of Regeneration.

9 MMSD'S ECONOMIC SUSTAINABILITY

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our economic sustainability?

Our economic sustainability—*our ability to meet the region's water reclamation needs while holding the line on costs year after year*—is important to the economic health of the region. Saving money, providing jobs and contributing to an economic climate that generates wealth help the District's cost-effectiveness side of the equation.

Why we care...

MMSD is a state-chartered regional agency that receives public funding from local ratepayers; the funds that are leveraged for projects must be used responsibly to maintain an excellent credit rating and a sustainable economic future. At MMSD, we know that it's important to undertake long-range financial planning for both capital and operation and maintenance (O&M) budgets. This helps us maintain relatively stable and sustainable user charge billings and tax levies; it ultimately avoids "rate shock" and saves money. We minimize financial burdens on our taxpayers in many ways, including maximizing funding from outside sources (such as through low-cost loans and grants) and maximizing revenues. MMSD has received $5 million in grant funding over the last five years for green infrastructure projects and nearly $8 million in grant funding for the Greenseams® Program (since 2002).

In addition, we limit the ratio of outstanding debt to equalized value to no more than 2.5% (state law allows up to 5%). And finally, we allow for 25% cash financing over each six-year capital program.

While it's important to select low-cost alternatives for projects to minimize costs, we also know it's important to balance low costs with project needs and benefits. This includes our projects that manage fixed costs, particularly during wet weather. While reducing dry weather flows does little to affect fixed costs, reducing peak loads can save real dollars.

In addition to maximizing funding and minimizing/balancing costs, retaining a knowledgeable and competitive workforce is critical. A well trained, experienced workforce knows how to save money and find efficiencies. Likewise, finding willing and capable partners helps as well, such as the various green infrastructure partners we frequently work with.

We remain committed to supporting a strong regional economy. Many of the workforce practices listed in Chapter 10 support this. Additional practices related to purchasing are likewise important. Sustainable purchasing is a practice embraced by MMSD because we recognize that much of our impact in the region is caused by what we buy and how we buy it. Our Procurement Department calculates the full life-cycle costs of products and services to minimize costs and maximize returns.

What we can do...

We will continue to seek out alternative funding sources to fund necessary projects. These include both public and private sources of funding, and new ways of doing things.

We will also continue to improve efficiency in all aspects of what we do. We will continue to look toward new technologies and ways to reduce waste and energy use while improving the treatment process and day-to-day operations.

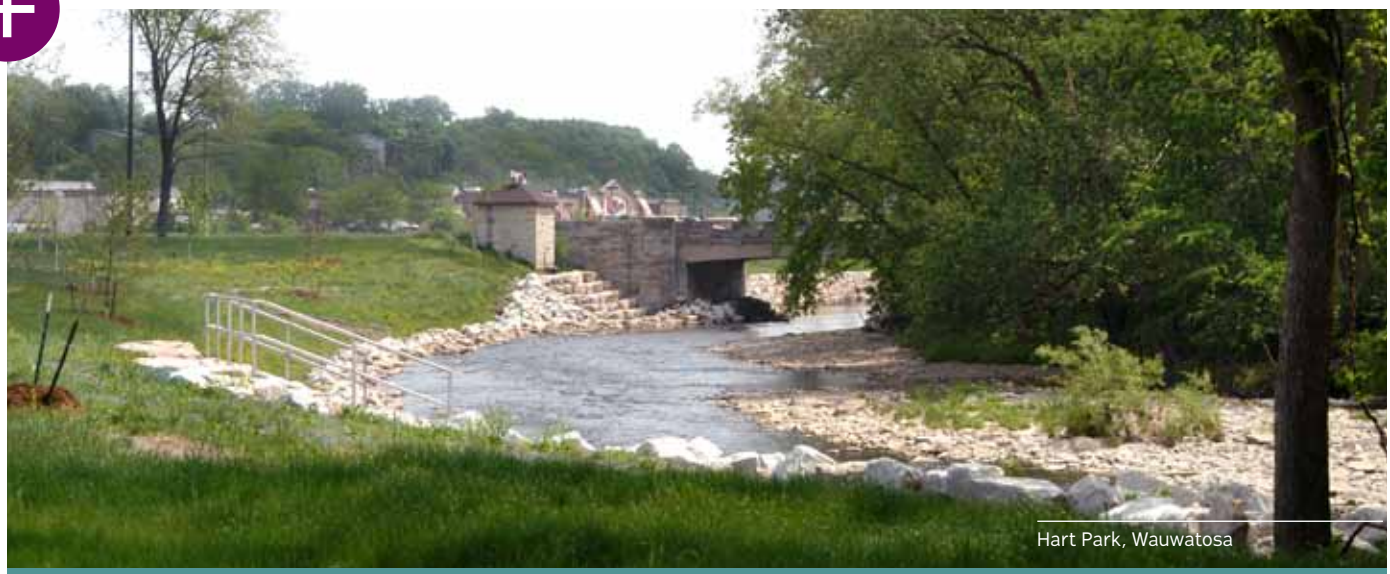
Life-cycle costing will increasingly be used for comparing project alternatives, particularly those related to green infrastructure. This approach will continue to provide a better understanding of long-term costs of short-term decisions. Likewise, there are a number of cost-benefit tools that MMSD will investigate, screen, and adopt. Of particular interest is triple-bottom line accounting used to quantify sustainability.

Supporting the regional economy is important to the long-term future of the 1.1 million people who live here. Besides the sustainable purchasing and workforce development policies mentioned elsewhere in this document, partnering with others is an important way to effect change and financial stability. Partners may include (and certainly not be limited to) the M7 Water Council, the Southeastern Wisconsin Watersheds Trust, Inc., and the Great Lakes Water Institute and new UW-Milwaukee School of Freshwater Science.

Innovation has been described as both the keys to economic recovery as well as the key to a sustainable future. Innovation both builds jobs and builds a sustainable way forward. Where new jobs and a sustainable economy overlap is the opportunity space of innovation, and MMSD can provide some of that for the region: space for social innovation, space for economic sustainability and space for environmental protection. We can host this space at MMSD facilities in line with MMSD Commission policy.

Urban Ecology Center, Milwaukee

Triple bottom line accounting refers to accounting for three categories of cost: people, planet and prosperity/profit. When used effectively, triple bottom line accounting can enhance transparency and accountability in government.



Hart Park, Wauwatosa

LIFE-CYCLE COSTS

These are the full costs—both monetary and non-monetary—of a project or undertaking. Life-cycle costs, also known as whole-life costs, include environmental and social costs as well as economic costs, and span the entire life of an asset. The life of an asset may include planning, design, construction, operations, maintenance, renewal/rehabilitation, depreciation and finance.

Knowing a project's or undertaking's life-cycle costs can provide a more accurate picture of its true costs. This can provide better information for decision-making. For instance, a project with high up-front costs may have low maintenance costs, and so considering the full life-cycle costs will lead to a better outcome.

Pre-Construction Rendering of Hart Park

This is particularly important in the context of tightening municipal budgets and needing new approaches to old problems. Green infrastructure is a prime example because it may have lower up-front costs in many cases, but also potentially higher maintenance costs.

What goals have we set...

Reduce costs/maximize value in all financial transactions.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- Find enhanced and alternative funding sources/revenue streams for both capital and operations and maintenance work (including increasing Milorganite®'s net revenue and reusing waste as a resource).
- Explore life-cycle costing, triple bottom line accounting, and other alternative methods.
- Provide regional economic support/partnerships/empowerment.
- Support innovation for operating technologies, source fund generation, etc.

10 MMSD'S SOCIAL SUSTAINABILITY

Milwaukee Community Service Corp. Students

MMSD's mission is to cost-effectively protect the quality of the region's water resources.

What's the connection to our social sustainability?

Our social sustainability—*how we treat our staff and how our actions affect the 1.1 million people who live in the region*—is vital to a healthy environment. That environment naturally includes resources on the land as well as water resources throughout the region.

Why we care...

MMSD takes very seriously our duty to cost-effectively protect the quality of the region's water resources. We do this for the good of the region's population, and we know it's the right thing to do. Through water resource protection, we enhance the collective quality of life for people who live and do business in this region.

To accomplish this, MMSD knows that we must retain a knowledgeable and effective staff capable of carrying out the work in experienced, yet innovative ways. MMSD must be able to attract professionals (including interns) who are the best and the brightest in their fields so we can continue to evolve and remain one of the Nation's most highly respected clean water agencies.

Outreach plays an important role in this and in building a well-informed public. Without adequate outreach, people in the region would be unaware of how to correctly operate and maintain parts of the sewer system—downspouts, sewer laterals, and green infrastructure—that are on their property. MMSD faces an ongoing challenge when we engage the public in the roles they can play as part of the solution. As such, it's vital that our staff are involved

Workforce Development

SWMBE Workforce Development Graduation, 2011

in molding and implementing water resource outreach and education efforts that are well received by the public, in ways that effect real change.

As part of the work MMSD staff designs and constructs, it is necessary from time to time that we hire outside resources—consultants, construction workers, inspectors—to accomplish the work that needs to be done to protect our water quality. In fact, it is our intent to maximize the local economic impact of our annual operating and capital spending for the benefit of the region's taxpayers through our Local Office Preference policy. By hiring workers in our community, we help keep money in the local economy. Workers we hire reflect the diversity of the customers we serve and who pay taxes and user fees for our services and infrastructure improvements. This is reflected in our economic development policies like Small, Women and Minority-owned Business Enterprise goals, our sustainable purchasing practices, our fleet vehicles (see Chapter 6), and our workforce development training and placement programs.

Taken together, the programs MMSD has in place are meant to retain and attract high-quality staff, improve the lives of people living in this region, raise environmental awareness, and provide opportunities for the benefit of all.

What we can do...

MMSD understands that staff is one of its greatest assets. Cross-discipline communication that fosters innovation will be particularly enhanced through a team approach to 21st century issues. We will continue to foster cross-divisional teams whenever there's a benefit to doing so.

Outreach and education will continue to be a mainstay of MMSD's program because a well-informed public can play a greater role in water resource management. Outreach and education must continue for children and adults alike, and must (1) generate awareness of how we maintain/improve the condition of area waterways and (2) create a noticeable shift in the behavior of constituents toward a more sustainable and conscientious way of consuming water resources. Emerging technologies need to continue to be part of the message delivery effort as well, including social media and next-generation collaborative workspaces.

Successful workforce development programs will continue to be aligned with the direct demand for new construction workers and apprentices on our capital improvement projects. These include procurement programs, such as those that include the solicitation of certified disadvantaged

Educational Water Activities at Milwaukee Sign Language School (MSLS)

businesses, providing a preference for local office professional services, encouraging mentor-protégé relationships, paying prevailing wage rates, requiring local workers on local jobs, and providing opportunities for apprentices (not to mention pathways to evaluate and improve on the above).

The Fresh Coast Jobs Initiative was recently conceived to help MMSD complete labor-intensive projects (both capital and operations and maintenance projects) and to provide job training for unemployed or underemployed local workers. Long term, it is expected that our program will create career pathways to full-time employment. Many of the new jobs will be so-called "green collar" jobs, or jobs likely to be part of the emerging 21st century economy. Typical green collar jobs are in the areas of green infrastructure, energy efficiency and renewables, waste reduction, and urban agriculture. Through this program and others that may mimic it, the Fresh Coast Jobs Initiative will foster public and private sector jobs.

What goals have we set...

Promote social sustainability for employees and throughout the region.

Next steps in this goal category include setting *measurable* goals in the following action areas:

- To retain knowledge and foster innovation, staff training and cross-disciplinary collaboration.
- Targeted public outreach and education, with annual message development and delivery.
- Local workforce development.

11 OUR NEXT STEPS

20th Street Industrial Corridor

An integrated systems approach to problem solving and how we think allows many parts of an issue to be reviewed simultaneously rather than breaking a problem down into its components and isolating them. It requires a shared vision, and when undertaken correctly can lead to real change because it creates (or at least identifies) value for a wide variety of stakeholders. This approach shares much in common with triple-bottom line accounting, and together these approaches can help us define a framework for sustainable change.

So what's next? Many things!

MMSD can form an internal, cross-divisional sustainability team charged with the following:

- Building on existing information and undertaking a readiness audit (in matrix form) to determine the extent to which recommendations can be integrated and adopted in the short, intermediate and long terms.
- Verifying the goals and the associated actions in Chapters 3-10.
- For each of the associated actions, crafting a measure of success that can be quantified and tracked through time.
- Developing an implementation schedule for priority recommendations.
- Promoting progress—through outreach and internal in-reach—to further drive the shared vision of sustainability.
- Annually reevaluating the recommendations contained herein.
- As warranted, updating this sustainability plan to reflect current thinking and direction.

Coming together is a beginning; keeping together is progress; working together is success.

–Henry Ford

All of this will require the on-going use of an integrated systems approach to how we think about our resources and our wastes (and where the two intersect). Sustainable projects that address many issues simultaneously may prove more valuable than traditional approaches developed to solve single-faceted problems. For instance, an integrated systems approach to green infrastructure recognizes the link between water use and energy use, energy use and carbon emissions, carbon emissions and climate, climate and habitat, and so on. An integrated systems approach embraces all of these pieces and assembles the interested parties to provide something for everyone in the process and in the outcomes. In recognition of this, partnerships in southeastern Wisconsin have already been forged and maintained, and it is anticipated that these partnerships will continue to mature and bear fruit.

MMSD will continue to play a strong role in this region's collaborative efforts to improve the region's water resources. This is a crucial responsibility that builds heavily on our sustainable past and relies on relationships with partners throughout the Greater Milwaukee Watersheds for success. By identifying and assembling winning partner combinations for projects and programs that benefit our rate payers, we can help ensure a sustainable tomorrow.

Beach Sweep, South Shore Beach

Signing of Landfill Gas Pipeline Contract

Farmer's Market, Whitefish Bay

Milwaukee Metropolitan Sewerage District's 2035 Vision and Strategic Objectives

Revised December 20, 2010

In the last 35 years, the Milwaukee region has transformed its approach to water. This transformation has helped to clean up the area's rivers and to preserve Lake Michigan. The Milwaukee Metropolitan Sewerage District (MMSD) takes pride in this progress, and understands that it must continue this transformation by adapting and evolving to the changing world.

Looking forward to the next 25 years, MMSD sees a quarter century of efficiency, innovation, and sustainability. The vision for MMSD has two key elements: 1) Integrated Watershed Management and 2) Climate Change Mitigation/Adaptation with an emphasis on Energy Efficiency. For these elements, MMSD has laid the necessary groundwork and has the resiliency necessary to continue to serve as a model for both the region and the nation.

Guiding Principles

Sustainable Bottom Line

Future planning, design, and operational decisions will be made based on a Sustainable Bottom Line approach that considers balanced Economic, Environmental, Operational, and Social Values.

Water Quality Leadership and Collaboration

MMSD will continue to expand its leadership role in developing regional approaches to protecting and improving water quality. MMSD will continue to develop and foster strategic alliances in its planning and project implementation. MMSD will continue to advocate for a watershed approach to managing the region's water resources and will take a watershed approach to managing its own operations.

2035 Vision

MMSD envisions a healthier Milwaukee region and a cleaner Lake Michigan accomplished through its leadership in attaining zero overflows, zero basement backups, and improved storm water management. MMSD will be a model in its management of climate change impacts on wet weather and its focus on energy efficient and sustainable operations.

Strategic Objectives

Using these guiding principles and this Vision, the strategic objectives for MMSD for the year 2035 are as follows:

1. Integrated Watershed Management

An integrated approach to watershed management must be established that responds to inter-jurisdictional opportunities and limitations. This will be accomplished by continuing MMSD's pursuit of excellent permit performance at its water reclamation facilities, preventing problems through its ongoing maintenance programs, and improving upon the already significant capital investments made within MMSD's service area. MMSD must also expand on the integration of its efforts, where appropriate, with those of external public, private, and nonprofit sector partners.

This integrated approach will focus on the infrastructure of the watersheds, seeking a healthy balance between two types of infrastructure: grey and green. Grey infrastructure is comprised of the roads, pipes, treatment plants, and other impervious surfaces that store, convey, or treat water. Green infrastructure uses management approaches and technologies to infiltrate, evaporate, capture, and reuse water to maintain or restore natural hydrology. The preservation and restoration of natural landscape features, such as forests, floodplains and wetlands, are critical components of green infrastructure. On a smaller scale, green infrastructure practices include rain gardens, rain barrels, porous pavements, green roofs, bioswales, trees and tree boxes, and rainwater harvesting.

Integrated Watershed Management Goals:

a. Support a watershed-based permitting program and water quality trading program that improves environmental performance in a cost effective manner.

b. Work with MMSD's partners to strive toward zero basement backups.

c. Work with MMSD's partners to achieve, to the extent feasible, zero sanitary sewer overflows and zero combined sewer overflows.

d. Work with MMSD's partners to achieve zero homes in the 1% probability floodplain.

e. Acquire an additional 10,000 acres of river buffers through Greenseams® and other regional programs.

f. Use green infrastructure to capture the first 0.5 inch of rainfall.

g. Harvest the first 0.25 gallons per square foot of area of rainfall.

Integrated Watershed Management Initiatives:

a. MMSD will help municipalities within the District reduce the volume of flows they deliver to MMSD's sewer system cost effectively.

b. Continue to plan, design, construct, and operate MMSD's grey infrastructure to exceed regulatory and economic requirements.

c. Greenseams®

1) Expand the boundaries of the Greenseams® program to match regional watershed boundaries.

2) Designate a percentage of annual Greenseams® funding toward improving the rainwater storage capacity of the properties.

d. Maximize MMSD's ability to deliver public educational programming to increase the general public's support and understanding of its operations.

e. Integrate green infrastructure with MMSD's grey infrastructure.

1) Provide leadership and advocate for a change in the Federal, State, and local definitions of infrastructure to include green infrastructure.

2) Develop a plan that integrates the use of green infrastructure within the regional flood management program and municipal stormwater systems to maximize their effectiveness.

3) Establish performance measures for green infrastructure.

4) Establish regional ordinances that foster green infrastructure.

5) Prioritize by location the types and benefits of green infrastructure.

6) Establish implementation target levels for green infrastructure on five-year intervals.

7) Work with the M7 Water Council and local universities to develop a Great Lakes Center of Excellence for Green Infrastructure in Milwaukee.

2. Climate Change Mitigation/ Adaptation with an emphasis on Energy Efficiency

Becoming more efficient and renewable with energy usage will help MMSD adapt to changing climate, but it must also consider that climate change may have significant impacts on the District in ways beyond energy usage. As the global climate changes, there are likely to be changes within the hydrosphere.

Energy Efficiency and Climate Mitigation & Adaptation Goals:

a. Meet a net 100% of MMSD's energy needs with renewable energy sources.

b. Meet 80% of MMSD's energy needs with internal, renewable sources.

c. Use the Greenseams® Program to provide for 30% sequestration of MMSD's carbon footprint.

d. Reduce MMSD's carbon footprint by 90% from its 2005 baseline.

e. Anticipate, to the greatest extent practicable, and respond to a range of climate change impacts when considering surface water, groundwater, and the management of stormwater and floodwater.

Climate Mitigation & Adaptation Initiatives:

a. Create and support a robust southeast Wisconsin regional climate change modeling program that will help forecast climate change impacts.

b. Create an internal risk analysis process that characterizes near-, mid- and long term actions necessary to protect MMSD's existing investments in facilities and create new facilities, programs, and operational improvements that adapt to the wet weather impacts of climate change.

c. Expand green infrastructure to help to mitigate climate change and make the region more resilient in the face of intense storms.

Realizing a cleaner, healthier environment is within the District's grasp. Aggressive collaboration will be the key to success, and ensuring that the District utilizes a sustainable bottom line approach in taking the steps outlined in this Vision will make sure a balance is met as MMSD proceeds.

APPENDIX

Listing of abbreviations

Abbreviation/ Acronym	Full Description
BMP	Best Management Practice
CSO	Combined Sewer Overflow
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
FCGS	Fresh Coast Green Solutions
FOG	Fats, Oils and Grease
GI	Green Infrastructure
HHW	Household Hazardous Waste
HSW	High Strength Waste
I/I	Inflow and Infiltration
IJC	International Joint Commission
IPCC	International Panel on Climate Change
ISS	Inline Storage System (Deep Tunnel)
JIWRF	Jones Island Water Reclamation Facility
LEED	Leadership in Energy and Environmental Design
LOP	Level Of Protection
MGD	Million Gallons per Day
MIS	Metropolitan Interceptor Sewer
MMSD	Milwaukee Metropolitan Sewerage District
NPS	Non-point Source
O&M	Operations and Maintenance
SEWRPC	Southeastern Wisconsin Regional Planning Commission
SSO	Sanitary Sewer Overflow
SSSA	Sanitary Sewer System Area
SSWRF	South Shore Water Reclamation Facility
SWPPP	Stormwater Pollution Prevention Plans
SWWT	Southeastern Wisconsin Watersheds Trust, Inc.
TCF	The Conservation Fund
USGBC	U.S. Green Building Council
WBP	Watershed-Based Permit
WICCI	Wisconsin Initiative on Climate Change Impacts
WPAP	Water Pollution Abatement Program
WQI	Water Quality Initiative
WRP	Watershed Restoration Plan

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A great deal of additional information on MMSD's sustainability efforts is available for free download at www.mmsd.com

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11-112