Updates and Recommendations to the Milwaukee Metropolitan Sewerage District's Climate Change Mitigation and Adaptation Programs

Final Report

December 2019

Prepared for:

Milwaukee Metropolitan Sewerage District

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1 Executive Summary

The Milwaukee Metropolitan Sewerage District (District) has recognized the need to address climate change from both a policy and project perspective. As such, the District adopted a "Climate Change Adaptation" policy (Commission policy 1-11.06) in July 2019, (2019 Climate Policy) that directs the District to undertake "continuous reassessment of strategies to adapt to and mitigate the immediate and long-term deleterious effects resulting from climate change." This echoes language in the District's 2035 Vision statement that the District should "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." This report is part of the District's continuing effort to satisfy those directives.

In 2014 the District commissioned a Climate Change Vulnerability Analysis to outline actions the District can take in response to identified risks associated with the impacts of climate change. After investigating the status of the 2014 report's recommendations, this report concludes that none of the activities recommended in 2014 are "mostly complete," about half are ongoing, and the remaining half have not been started. As discussed in more detail in Section 3, the 2014 recommendations cover a wide range of activities, some of which deserve priority and others for which the suggested triggers have not occurred. Importantly, the District has developed several innovative projects and programs outside of the recommendations in the 2014 analysis, including green infrastructure funding and an internal energy generation project involving landfill gas reuse.

The first objective of this report is to evaluate the District's progress in implementing the recommendations in the 2014 Climate Change Vulnerability Analysis. This report provides a status update on each of the recommended activities responding to high-risk and moderate-risk climate impacts, determines if the recommendations that have not been addressed are still a priority, and identifies new opportunities based on practices at comparable utilities.

Second, this report is intended to assess the District's climate change readiness as compared to six utility peers. Based on publicly available information on climate mitigation and adaptation activities implemented by the six peers, as well as national frameworks and guidance documents for water and wastewater utility climate readiness, best management practices were identified and reviewed. The District is perceived as a national "green leader" and has implemented successful climate readiness projects, but this analysis based on a high-level review of publicly available policies, practices, and reports showed that the peer utilities may lead the

District in some areas such as carbon emissions measurement and reduction and energy efficiency improvements.

Third, this report proposes several recommendations for the District to strengthen its leadership position on climate readiness, and to operationalize its powerful statements of intent. Specifically, the District should:

- Evaluate its energy usage and carbon emissions, and develop strategies to incorporate energy efficiency into operational, planning, and procurement decisions;
- Implement selected projects recommended in the 2014 Vulnerability Analysis that have not yet been started, but that directly align with the District's mission, national standards, and/or peer utility actions (marked with an asterisk in Table 1);
- Continue its existing initiatives in green infrastructure and methane-to-energy programs;
- Implement and integrate the climate-related recommendations in the 2019 Resilience Plan; and
- Conduct periodic reviews of its climate policies and associated activities and projects, potentially aligning the review period with the quadrennial time cycle for the federal government's National Climate Assessment reporting process.

2 Introduction

The District is a regional government agency that is responsible for water reclamation and flood management protection for 28 municipalities spanning over 400 square miles. The District plans for replacement of equipment, maintenance of the infrastructure system and adjustments to operations, all of which are expected to be impacted by climate change, including changes in precipitation. The District is committed to climate resilience—"the ability to anticipate, prepare for, and respond to hazardous events, trends or disturbances related to climate. Improving climate resilience involves assessing how climate change will create new, or alter current, climate-related risks, and taking steps to better cope with these risks." (Center for Climate and Energy Solutions, 2019).

The 2019 Climate Policy details how changes in the Wisconsin climate will affect the District's operations. The District's 2012 Sustainability Plan, discussed in more detail below, forecasts increasingly severe storms for southeastern Wisconsin, and predicts increasing temperatures that will result in more heat waves. These predictions are based on over six decades of temperature and precipitation data collected by the Wisconsin Initiative on Climate Change Impacts (WICCI) and are summarized in the Sustainability Plan. For example, WICCI predicts an increase in large, more intense precipitation events along with potential decreases in smaller storms. Winter precipitation may fall as rain rather than snow. This climate variability will put additional stress on the District's critical infrastructure systems related to maintenance, operations, improvements, and expansions.

These climatic changes may also affect the District's ability to comply with its Wisconsin Pollutant Discharge Elimination System (WPDES) permit. The permit limits the District to *either* no more than six combined sewer overflows (CSO) per year, *or* treatment of 85% of the system wide volume of combined sewage collected in the combined sewer system as the result of precipitation events, reported on an annual average basis. The most recent version of the permit, issued earlier this year, establishes goals that the District "shall implement wet weather management programs," with a "green infrastructure retention capacity goal to be achieved during the term of this permit" of 50 million gallons with 20 million gallons of that being collected within the District's combined sewer service area. Continued increases in rainfall intensities and amounts will make permit compliance more difficult and, as detailed below, the District has set even more aggressive performance goals in its own planning documents.

To support its ability to achieve these quantitative permit requirements and goals into the future, the District has taken a strategic leadership stance on climate

change. This is evident most recently in the 2019 Climate Policy but also in a series of planning documents and programs issued and implemented over the last 15 years, as described below.

2005 Environmental Sustainability Policy. The Environmental Sustainability Policy broadly directs the District to act as an environmental steward for local watersheds through the pursuit of policies, programs, and practices focused on sustainability and the preservation of natural resources.

2035 Vision Statement. The District's 2035 Vision Statement is divided into two complementary strategic objectives: first, integrated watershed management, and second, climate change mitigation and adaptation, emphasizing energy efficiency. The Vision sets several aggressive goals for the District's 2035 operations, including meeting a net 100% of the District's energy needs with renewable sources, including 80% from internal sources; providing 30% sequestration of the District's carbon footprint; and reducing the carbon footprint by 90% from its 2005 baseline. The Vision also calls for zero sanitary or combined sewer overflows and zero basement backups by 2035, goals that will be increasingly challenging considering the anticipated climate impacts described in the 2019 Climate Policy.

2012 Sustainable Water Reclamation Plan. The District's 2012 Sustainable Water Reclamation Plan includes a full chapter examining the District's ability to prepare for climate change. It summarizes WICCI climate predictions, including increased frequency of severe rainfall events and increased temperatures. In response, the Plan identified a need for the District to undertake mitigation activities (to reduce risks and hazards associated with climate change) and adaptation activities (to adjust to inevitable climatic changes). Several potential mitigation activities are identified such as measuring and reducing the District's carbon footprint, funding research aimed at downscaled climate models, and increasing green infrastructure installations to slow runoff and serve as carbon sinks. Suggested adaptation activities included capacity enhancements via both grey and green infrastructure projects, inflow and infiltration fixes, and a regional integrated planning process.

2014 Climate Change Vulnerability Analysis. The 2035 Vision statement expressly called for a "risk analysis" to characterize "near-, mid- and long-term actions necessary to protect the District's existing investments in facilities." The 2014 Vulnerability Analysis did so by assessing potential climate vulnerabilities in District facilities and operations, and by creating its own rainfall and temperature projections. To address the identified risks, the 2014 report recommends that—among other things—the District implement certain "no regrets" activities assessed

to provide multiple benefits including reduction of climate change impacts and that will increase the resilience of District operations regardless of whether projected climate changes occur. Section 3 of this report examines these actions and the District's progress in implementing them.

2019 Resilience Plan. The 2019 Resilience Plan provides a framework for how the Milwaukee metropolitan area can address complex risks to become a stronger, more resilient region. Climate change is an identified risk that has impacts beyond critical infrastructure systems. The Resilience Plan highlights that environmental and socio-economic issues are "on a collision course over the next several decades." Critical infrastructure systems are becoming increasingly vulnerable to increased precipitation and temperature extremes likely to be experienced in southeastern Wisconsin. Thus, the Resilience Plan recognizes broader ties between climate readiness and economic vitality. While the District remains devoted to its primary missions, the Resilience Plan recognizes and describes more holistic goals and strategies that will reduce risks and strengthen the communities in which the District operates.

2019-21 Strategic Plan. The District's 2019-21 Strategic Plan recognized climate resilience as a key goal and driver of the District's future planning and identified several strategies to improve the region's ability to respond to climate change. These include:

- Reducing energy use and converting to renewable energy sources after tracking energy and emissions baseline data;
- Implementing relevant tasks from the Resilience Plan; and
- Increasing green infrastructure and protecting green places, with a goal of implementing 10 million gallons of green infrastructure annually.

These strategies closely track the recommendations of this benchmarking report.

Public engagement and awareness is another goal of the 2019-21 Strategic Plan. While not directed only at climate change issues, the plan recognizes the importance of regularly and authentically engaging the community on a variety of topics.

2019 Climate Policy. In addition to describing the likely effects of climate change on the District's operations, as described above, the Climate Policy directs that the District should account for climate effects in operations and planning; that it should use renewable energy whenever feasible, in accordance with Wisconsin Statute § 1.12 (Energy Policy), and that it should develop and use increasingly efficient technologies to carry out its duties related to water reclamation, stormwater management, and flood management.

The Climate Policy also directs the District to undertake "continuous reassessment of strategies to adapt to and mitigate the immediate and long-term deleterious effects resulting from climate change."

2050 Facilities Plan. Anticipated to be complete in 2020, the District's forthcoming 2050 Facilities Plan identifies climate adaptation and mitigation as "the most important driving force" for operations. It recommends further expanding green infrastructure installations for climate adaptation and increasing reliance on renewable energy sources for climate change mitigation.

The District has long been recognized as a thought leader in climate change responsiveness strategy and as a "green leader" utility. (NRDC 2011, Wisconsin Sea Grant 2016, Hopkins 2016). This report, issued shortly after the 2019 Climate Change Policy, is intended to benchmark and assess the District's current progress in reaching the high-level goals outlined in earlier planning documents, and to assess the District's progress relative to comparable agencies in similar municipal settings. The next step for the District's climate change efforts is to implement and operationalize the broader vision expressed in these planning and strategy documents.

3 2014 Vulnerability Analysis

In 2014, the District commissioned a Climate Change Vulnerability Analysis (report) intended to assess how soon and how likely it was that climate impacts would present "a meaningful threat to existing and planned facilities and operations." The objectives were to provide information for future decisions on capital improvements and operational strategies, to assess the timeline for climate threats to local operations, and to quantify risk and develop adaptation strategies. The resulting report predicted changes in area temperature and precipitation and quantified the risk of the impacts to aid the District in developing adaptation and mitigation strategies. The report predicted that larger precipitation events would become more intense, while smaller precipitation events would become less intense and less frequent. A moderate increase in the average flow from the combined sewers driven by higher peak runoff from more intense precipitation events was also predicted. In turn, it stated, this could decrease the effectiveness of the District's flood management levels of protection.

To address these risks, the report suggested that the District should:

- Implement certain "no-regrets" actions that would be beneficial regardless of the degree of climate change;
- Continue to monitor changes in precipitation and temperature;
- Implement adaptation actions in response to particular triggering events; and
- Compile data on its energy costs and climate indicators including temperature, precipitation, and vegetation stress.

The report identified and assessed numerous potential vulnerabilities to District facilities and operations. It summarized various suggested "No Regrets Activities" and "Adaptation Actions" for identified high-risk and moderate-risk climate impact. It defined "no regrets" activities as actions that will provide multiple benefits including reduction of climate change impacts and that will increase the resilience of District operations regardless of whether projected climate changes occur. Conversely, it recommended that the District implement the "adaptation activities" only if certain triggering events or conditions occurred. The "high risk" and "moderate risk" impacts were divided into six categories representing aspects of the District's facilities and operations: metropolitan interceptor sewers and inline storage system (MIS/ISS), water reclamation facilities (WRF), watercourses, green infrastructure (GI), facilities management, and landfill gas systems.

In April 2019, the authors of this report conducted a series of interviews with District staff responsible for each of the six categories to assess the extent to which the District has implemented the recommendations in the report. Staff were asked

whether implementation activities for each recommendation were mostly complete, ongoing, or not started. Staff were also asked whether the District is implementing other important climate mitigation or adaptation activities not covered in the 2014 report, and finally, whether they had recommendations for other response activities not already identified.

Below, Tables 1 and 2 summarize the results of the interview process. The columns in the tables have been reproduced from the original report, except the three added columns specifically noted below. The columns represent the following concepts:

- Operational Category (added for this report) – the potentially affected category of District operations.
- Impact – the potential effects of climate change identified in the 2014 report that may materialize at a level to present a meaningful threat to existing and planned District facilities and operations.
- "No Regrets" Activities – actions recommended in the 2014 report that will provide multiple benefits including reduction of climate change impacts and that will increase the resilience of District operations regardless of whether projected climate changes occur.
- "No Regrets" 2019 Implementation Level (added for this report) – the current status of the "no regrets" activities identified in the 2014 report, as determined from 2019 interviews with District staff.
- Adaptation Actions – the actions recommended in the 2014 report to be implemented only if certain triggering events occur, for the primary or sole purpose of addressing the impacts of projected climate change.
- Adaptation Trigger – the threshold point identified in the 2014 report at which the investment in the identified adaptation actions becomes justified.
- Adaptation 2019 Implementation Level (added for this report) – the current status of the adaptation actions identified in the 2014 report, as determined from 2019 interviews with District staff.

Finally, Table 3 provides a quantitative assessment of the staff-described implementation level: not started, ongoing, or mostly complete. Of the 14 "no regrets" activities identified to respond to high-risk climate impacts, none are mostly complete, eight are ongoing, and six have not been started. Of the five additional "no regrets" activities identified to respond to moderate-risk climate impacts, none are mostly complete, four are ongoing, and one has not been started.

With respect to adaptation actions responding to high-risk climate impacts, none are mostly complete, six are ongoing, and seven have not been started. Of the seven

additional adaptation actions responding to moderate-risk climate impacts, none are mostly complete, one is ongoing, and six have not been started.

Notably, in some cases the triggering events specified in the report have not occurred, meaning that no adaptation activities would be recommended yet. In some cases, these triggering events are physical indicators (e.g., temperatures exceeding certain thresholds). Other triggers are regulatory-based (e.g., FEMA or EPA actions). An in-depth analysis of whether each trigger has occurred is generally not feasible because there is a lack of clear metrics for what the trigger may be.

Activities marked with an asterisk (*) have been identified as high-impact projects that the District should consider for near-term implementation due to direct alignment with the District's mission, national standards, and/or actions underway by the six peer utilities examined later in this report.

Table 1: "No Regrets" Activities and Adaptation Actions for High-Risk Impacts (Table 2-23 from 2014 report) (revised to show operational categories and 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
MIS/ISS	Increased MIS/ISS operational costs	Install more energy efficient equipment as equipment is replaced; maximize use of onsite-generated power for ISS pump stations	Not started*; onsite power generation is structurally infeasible at some locations	Replace MIS pump stations with gravity systems as determined feasible by life cycle evaluations of potential redesigns	Cost-effectiveness as determined by feasibility study	Not started
MIS/ISS	Increased incidence of external power outages at MIS control structures, MIS pump stations, ISS control structures	Confirm that all critical structures have adequate backup power; confirm that procedures are in place that will allow backup power to be used without interruption to services; upgrade backup power if necessary	Ongoing (mostly complete for pump stations; not started for ISS control structures)	None	N/A	N/A
MIS/ISS	Overheated electronics in monitoring and control systems at MIS control structures, ISS control structures, and WRFs	Invest in control technologies that are less sensitive to excessive temperatures or adopt a "run to failure" strategy with adequate system backups in place	Not started	Increase ventilation and/or insulation of critical electronic equipment	Temperatures exceed thresholds established for equipment operation	Not started

Table 1: "No Regrets" Activities and Adaptation Actions for High-Risk Impacts (Table 2-23 from 2014 report) (revised to show operational categories and 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
WRF	Increased treatment due to perception of District's contribution to reduced water quality and/or increased algal growth	Continue interaction with community, USGS, universities, and regulatory agencies to maintain situational awareness of potential changes	Ongoing	Conduct or support water quality studies to ensure causes of the problem are properly identified; continue long-term and active research partnership with USGS; adjust processes and practices to comply with revised limits; initiate pollutant trades	Permit revisions enacted	Ongoing
MIS/ISS, WRF	Increased odor and corrosion potential in MIS/ISS and WRF facilities	As sewer or force main replacements or linings occur, consider material resistant to hydrogen sulfide (H2S)	Ongoing	Implement odor control measures and protect concrete surfaces	Confirmation of trend of increased H2S concentrations	Ongoing
WRF	Increased WRF operational costs	Implement energy reduction strategies; change processes/equipment to minimize exposure to energy costs as processes/equipment are upgraded	Ongoing	Change processes/equipment to minimize exposure to energy costs	Cost-effectiveness as determined by feasibility study	Ongoing

Table 1: "No Regrets" Activities and Adaptation Actions for High-Risk Impacts (Table 2-23 from 2014 report) (revised to show operational categories and 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
Watercourses	Reduced flood management level of protection	Consider incremental cost of incorporating potential flow increases into design of new flood management projects; maximize implementation of green infrastructure practices	Ongoing	Retrofit projects based on increasing flow trends	Hydrologic study indicating flow increases or increased regulatory flows issued by FEMA	Ongoing
Watercourses	Higher regulatory flood elevations and expanded floodplains	Consider incremental cost of incorporating potential flow increases into design of new flood management projects; maximize implementation of green infrastructure practices; consider requiring new development and redevelopment to use increased precipitation when sizing BMPs; continue funding long-term flow and stage gaging stations with USGS/SEWRPC	Ongoing	Retrofit projects based on increasing flow trends; revision of Chapter 13	Hydrologic study indicating flow increases or increased regulatory flows issued by FEMA; regional acceptance of NOAA Atlas 14 precipitation data	Ongoing

Table 1: "No Regrets" Activities and Adaptation Actions for High-Risk Impacts (Table 2-23 from 2014 report) (revised to show operational categories and 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
Watercourses	Vegetation in channels and flood management facilities shifts toward species adapted to warmer or drier conditions	Develop species mix for projects with consideration of acceptable vegetation performance under (a) warmer or drier future conditions and (b) salt tolerance	Not started*	Increase maintenance to prevent unacceptable vegetation performance	Observation of vegetation stress	Not started
Watercourses	Increased need for disease vector control in channels and flood management facilities	Analyze areas with potential to generate West Nile, Lyme Disease, and other potential vectors. Develop vector control plan. Update regularly	Not started	Conduct additional vector control activities on District properties	Observation of increased or unacceptable levels of vectors	Not started
Watercourses, GI	Reduced Chapter 13 effectiveness leading to watercourse bank instability	Implementation of green infrastructure in areas or developments where mitigation not required under Chapter 13	Ongoing	Increase bank reinforcement along District watercourses	Confirmation of increased flow erosiveness by observation or model studies	Not started
Watercourses	Increased watercourse bed/bank erosion and sediment transport	Implementation of green infrastructure in areas or developments where mitigation not required under Chapter 13	Ongoing	Increase reinforcement levels along District watercourses, increase annual sediment removal activities	Confirmation of increased sediment transport or deposition by observation or model studies	Not started

Table 1: "No Regrets" Activities and Adaptation Actions for High-Risk Impacts (Table 2-23 from 2014 report) (revised to show operational categories and 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
GI	Green infrastructure vegetation shifts toward species adapted to warmer or drier conditions	Develop species mix for projects with consideration of acceptable vegetation performance under (a) warmer or drier future conditions and (b) salt tolerance	Not started*	Increase maintenance to prevent unacceptable vegetation performance	Observation of vegetation stress	Not started
WRF, Facilities	Increased building operational costs	Implement energy reduction strategies, install more energy efficient equipment as equipment is replaced	Ongoing	Budget for increased costs if they cannot be avoided by energy reduction strategies	Comparison of year-to-year energy expenditures	Ongoing

* Indicates "not started" projects that the District should consider for near-term implementation due to direct alignment with District mission, national standards, and/or peer utility actions

Table 2 shows the "No Regrets" activities and adaptation actions for identified moderate-risk impacts:

Table 2, "No Regrets" Activities and Adaptation Actions for Moderate-Risk Impacts (Table 2-24 from 2014 report) (revised to show 2019 implementation levels)

Operational Category	Impact	"No Regrets" Activities	"No Regrets" 2019 Implementation Level	Adaptation Actions	Adaptation Trigger	Adaptation 2019 Implementation Level
WRF, Facilities	Restrictions on emissions for mechanical operations, fleet, etc.	Incorporate low emission technology when upgrading facilities/fleet; incorporate energy efficient designs during upgrades	Ongoing	Retrofit to reduce emissions	EPA requirement	Not started
WRF	Increased dry rot on exposed District facility wooden piles	As 2050 Facilities Plan considers District facilities, ensure that replacement of facilities on piles is evaluated	Ongoing	Reinforce pilings or artificially increase local groundwater levels to submerge piles	Confirmation of trend of lower lake level that would expose piles	Not started
WRF	Increased flood damage to buildings and equipment	Incorporate floodproofing measures into upgrades where appropriate	Ongoing	Conduct site improvements to increase level of protection	Rainfall records indicate unacceptable increase in probability of flood damage	Not started
Watercourses	Increased risk of overtopping or exceeding capacity of District constructed flood management facilities	N/A	N/A	Reconstruct channels or retrofit flood management structures	Risk of damage to overtopping justifies the cost of retrofit	Not started

Table 2, "No Regrets" Activities and Adaptation Actions for Moderate-Risk Impacts (Table 2-24 from 2014 report) (revised to show 2019 implementation levels)						
Operational Category	**Impact**	**"No Regrets" Activities**	**"No Regrets" 2019 Implementation Level**	**Adaptation Actions**	**Adaptation Trigger**	**Adaptation 2019 Implementation Level**
Watercourses	Reduced habitat, navigation and fish passage	Incorporate habitat diversity and resiliency of function within designs	Not started	Reconstruct channels to provide narrower low-flow insets	Lost benefits are deemed to justify the cost of construction	Not started
Landfill gas system	Reduced turbine cooling water intake capacity	N/A	N/A	Construct redesigned intakes and/or pumping system	Confirmation of trend of lower lake level to level that would adversely affect operability and costs justified by energy produced	Not started
Landfill gas system	Increased demand for energy from turbines	Reduce energy usage in operations	Ongoing	Increase turbine use to the extent possible and/or add turbine generating capacity	Energy costs less to produce than purchasing on the open market	Ongoing

	Table 3: Summary of implementation of 2014 Vulnerability Assessment			
	Total Identified	**Mostly Complete**	**Ongoing**	**Not Started**
"No Regrets" activities responding to identified high-risk impacts	14	0	8	6
Adaptation activities responding to identified high-risk impacts	13	0	6	7
"No Regrets" activities responding to identified moderate-risk impacts	5	0	4	1
Adaptation activities responding to identified moderate-risk impacts	7	0	1	6

As noted above, during the interviews, District staff were asked about the status of the 2014 recommendations, and also were asked to volunteer information they believed to be relevant regarding other District climate resilience initiatives not covered in the report and about initiatives ongoing elsewhere that the District should consider implementing. The interview content related to the status of the 2014 recommendations centered on three common themes: energy efficiency, community and research partnerships, and flood management, as described below. Staff also emphasized two District initiatives that have been pushed forward largely outside the confines of the report: widespread incentivization of green infrastructure, and energy generation using methane gas piped from a nearby landfill.

Energy efficiency. Energy efficiency is a leading consideration in the report, the District's 2035 Vision, and the District's Facilities Plans. For this updating effort, it was beyond the scope to identify the number of recommended energy efficiency projects that are complete, are underway, are not being pursued, or have not been

started. District staff reported room for improvement in connecting the District's broadly expressed energy efficiency goals with individual project scope, design, equipment procurement and operational decisions.

The District routinely includes improved energy efficiency as a general goal when defining the scope for a new project. The project scope, goals and related design requirements are typically transferred to the scope of the consultant engineering contract, often with broad instructions to consider energy efficiency as part of the design and specifications. Similarly, the District's standard consultant engineering contract incorporates a requirement related to Clean Water Loan Fund projects for a Cost & Effectiveness Certification that considers energy conservation (although staff reported that the required certification is relatively ambiguous). These types of general directions may be insufficient to ensure that the design team selects equipment in line with the District's energy goals.

Instead, staff reported a need for District staff to better define the project scope and subsequent engineering consultant contract scope to provide more details relative to energy efficiency and conservation. In addition, the District could create well-defined design guidelines and/or specifications reflective of the District's broader energy efficiency goals to make the procurement process easier for project managers and design teams. Although the District is required to award contracts to the lowest bidder, contract specifications that incorporate energy efficiency performance standards can ensure that the low bid reflects the energy efficiency goals of the project.

The District has certainly driven some energy efficiency success stories, such as the installation of variable frequency drives and replacement of low-efficiency lighting fixtures with LED lights, but the improvements are not system-wide and are not connected to a more strategic approach. Instead, equipment is often replaced in kind to remain compatible with the surrounding system. In this case, identification of a different product may not be viable because the replacement must work as part of a larger existing system. Other times, significant energy efficiency gains are not possible, and equipment reliability, familiarity or cost emerge as top considerations.

The District has an "Energy Team" to provide select internal staff and other stakeholders the opportunity to collaborate, share energy related information and identify opportunities for energy conservation. However, District staff outside the Energy Team are not fully aware of the team's existence or mission. The District also monitors energy use and costs: although usage records are not readily available now, they are likely to become available by 2020 as a result of the District's implementation of Scope 5, an energy reporting software system.

Given these various considerations, District staff reported an aspiration to better incorporate energy efficiency in project scope, design, procurement and operational decisions. The District should strongly consider steps to systematically define and communicate strategic long-term, interim and short-term energy targets to divisions, departments and individual staff; and to better define how individual projects and initiatives can move the District closer to achieving the goals expressed in the District's 2035 Vision. Staff suggested the development of a system-wide strategic approach that could set clear organizational targets for energy goals, data availability, accounting methods and standards. The District should also track performance and results after completion of a project or initiative to determine how well the chosen methods achieved energy goals. This combined approach should also create a clear path with intermediate steps to completion that can be translated to quantitative energy goals for individual projects and organizational levels.

Community and research partnerships. District staff reported that outreach to community partners is a continuous, ongoing process that needs to be strengthened. The District Strategic Plan recognizes the importance of communicating with the public and building awareness and support for the work in the community. Staff reported that some of the District's community interactions could be improved, particularly as to the District's contribution to water quality and algal growth (based on prior studies, staff believe it to be minimal as compared to nonpoint source impacts, but that message has not fully reached the community). The District also maintains ongoing partnerships with the United States Geological Survey (USGS) and local universities for a variety of research purposes.

Flood management. The District has incorporated potential flow increases into at least one new project design and is reviewing adding enough freeboard to account for 2050 rainfall projections. Going forward, future climate projections will be incorporated in project planning efforts. The District evaluates and incorporates green infrastructure into flood management projects when feasible. However, the vegetation mix in flood management and watercourse projects is primarily driven by a preference for native species, not for species that can tolerate warmer or drier conditions.

District initiatives not featured in 2014 Vulnerability Analysis. District staff were also asked to describe other programs and efforts that the District has undertaken aside from the recommendations of the report. Two of them are featured here: the District's nationally recognized green infrastructure program and the District's innovative project transforming landfill gas to energy.

Green infrastructure. Green infrastructure was not a central feature of the 2014 Vulnerability Analysis. However, green infrastructure has long been recognized as an effective measure for climate change mitigation and adaptation. It provides a

variety of ecosystem services, decreases the effects of urban "heat islands," and reduce clear water flows in the District's conveyance system, among other benefits. In the long run, stormwater detention via green infrastructure is expected to support the grey infrastructure system, reduce stress and inflow, and improve water quality.

District staff reported a strong internal initiative to widely implement green infrastructure projects throughout the service area to absorb as much water as possible before it reaches grey infrastructure systems. The District's Regional Green Infrastructure Plan (2013) documents how to meet the District's ambitious goals: that the region's green infrastructure will capture the volumetric equivalent of the first 0.5 inch of rainfall on impervious surfaces, the equivalent of 740 million gallons of stormwater storage.

A capture volume that large will likely require green infrastructure installations on non-District owned and private properties. The District works to advance green infrastructure via the following strategies:

- The District's Green Solutions program provides financial incentives to District municipalities for District Commission-approved types of green infrastructure and combined sewer separation projects. The program is intended for projects in public places, thereby raising awareness of green infrastructure. The budget amount has increased over the past several years, with the 2020 amount being $10 million allocated based on equalized value. In total, from2013 to 2019, the District has provided $3.7 million to municipalities, resulting in 5.2 million gallons of capture in green infrastructure.
- The District invites applications for partnership funding through the District's Green Infrastructure Partnership Program (GIPP). The GIPP originated in 2012 and currently provides about $3 million per year in incentive funding. The program is open to public, private, and not-for-profit

A LEADER IN GREEN INFRASTRUCTURE

- Effective climate change adaptation and mitigation strategy
- District's aggressive goal: 740 MG of storage provided every time it rains
- Implementation goal in District's WPDES permit as a means of reducing sewer overflows, with biannual updates due
- The District has multiple programs to address implementers' funding constraints
- Innovative approaches necessary for installations on non-District owned (and even private) properties

entities. Since 2017, it has averaged about 3.4 million gallons of storage funded per year. In 2019, the GIPP changed to a "dollars per gallon of stormwater detention" model with most projects being reimbursed at $1.76 per gallon of detention.

- The District has launched a "Fresh Coast Guardians Resource Center" to assist with the technical aspects of green infrastructure project design, implementation, and operation. Project types could include rain barrels, rain gardens, green roofs, bioswales, porous pavements, and other techniques.

External evaluators have concluded that the Milwaukee region is a leader in green infrastructure implementation. A 2018 study analyzed long-term stormwater control plans and funding strategies in 25 major U.S. cities to evaluate their commitment to green infrastructure. Using quantitative metrics, the paper concluded that Milwaukee is one of five "green leader" cities. The authors further recognized Milwaukee's "long history of building momentum for green infrastructure." (Hopkins, 2018).

The District also recently revised Chapter 13 of its rules. All parcels under ½ acre (down to 5,000 square feet) of net new impervious must install green infrastructure to manage stormwater on-site. The City of Milwaukee has also recently created a "Green Infrastructure Plan" intended to add approximately 36 million gallons of stormwater storage via green infrastructure by 2030.

These initiatives support the District's ability to comply with its WPDES permit goal of implementing a total of 50 million gallons of green infrastructure retention capacity during the permit term, with 20 million gallons of that being within the District's combined sewer service area. The District will report progress towards this goal on a biannual basis.

Methane to energy. To reduce its energy footprint and to increase reliance on renewable sources of power, the District uses landfill gas piped from Franklin, Wisconsin, to its Jones Island Water Reclamation Facility (WRF) to produce power and

METHANE TO ENERGY

- The water reclamation process requires a tremendous amount of energy
- Reducing that energy usage is an important climate change mitigation and adaptation measure
- District transports landfill gas along a 19-mile pipeline from a landfill in Franklin to the District's Jones Island Water Reclamation Facility
- Energy created depends on amount of gas supplied
- District turbines have capability to assimilate significant additional amounts of gas

heat. The pipeline repurposes an existing natural gas pipeline that was slated for abandonment. The landfill conditions gas to District specifications and then sends it to the Jones Island WRF where, mixed with natural gas, it powers turbines. Staff report that the District could and would certainly accept more landfill gas if it were available; an enormous amount could be used at Jones Island to offset the amount consumed in biosolids drying operations. In a similar project, the anaerobic digesters at the District's South Shore WRF produce their own digester gas, which is transferred to engines to produce power and heat. As of 2018, the District internally produces 33.49% of its energy needs. This includes production using landfill gas, digestor gas, waste heat, and solar energy. (MMSD, 2019).

Conceptually, the District could generate enough power to release some back into the electrical grid, but this has not been done due to technology, policy, legal, and resource constraints. The South Shore WRF does not have the required system infrastructure interconnects and the District does not plan to install it there. The Jones Island WRF has the infrastructure to export power but does not do so, staff report, largely due to the legal terms and conditions imposed by the system operators (for example, the producer must be ready to deliver power when the system demands it). Instead, the District's goal is to insulate itself from excess price variability and to increase its renewable energy profile.

4 Best Practices for Wastewater Utility Climate Readiness

In addition to documenting the District's progress toward implementing the recommendations of the 2014 Vulnerability Analysis, this report benchmarks those recommendations and implementation achievements both to nationally accepted best practices for wastewater utilities, and to the actions taken by comparable utilities elsewhere. This includes an analysis of the potential legal barriers to climate actions undertaken by local and regional agencies and municipalities.

National Framework and Guidance

One measure of the District's climate readiness is a comparison to national guidance and framework for comparable utilities. The United States Environmental Protection Agency (EPA) has created an "Adaptive Response Framework for Drinking Water and Water Utilities" (EPA Response Framework). The EPA Response Framework identifies six readiness elements within an adaptive management cycle. The District has already made significant strides in achieving the framework elements identified below:

- Awareness: Engage the local scientific community (government and academia) to identify potential impacts that will challenge system assets, operations, and personnel, and begin researching how to integrate climate change into planning and decision-making efforts.
- Adaptation: Conduct a climate change risk assessment that identifies threats and examines climate readiness actions undertaken by similar utilities; then determine and implement adaptation options to reduce system vulnerability.
- Mitigation: Estimate energy sources and use, along with greenhouse gas (GHG) emissions; implement and evaluate energy management strategies.
- Policies: Review state and local laws and regulations to ensure compliance, including with current and future GHG emissions reduction incentives or requirements that may impact operations; establish relationships with relevant local and state officials.
- Community: Develop an outreach strategy that features frequent stakeholder communications; coordinate readiness actions with the community to increase resilience.
- Partnership: Identify and dialog with potential external partners to coordinate plans, implement coordinated actions, and continue outreach to the community.

Many of these actions were discussed or recommended in the 2014 Vulnerability Analysis, and others have already been voluntarily implemented by the District.

Perhaps of even more value to the District is the adaptive management process EPA recommends using "due to the evolving nature of climate change." The sequence of this cyclical process is: understand challenges, assess risks, develop plans, implement, and monitor performance. The monitoring will yield results that provide awareness of new challenges, beginning the cycle again. As discussed in Section 5, the District should periodically evaluate its plans and policies to ensure an optimal level of climate readiness.

Comparable Utilities

The climate readiness activities of six comparable peer utilities were reviewed to compare the District's progress and identify opportunities for improvement. The following utilities were selected based on city size, service area size, urban land use patterns, and recognition as innovative leaders on climate readiness: Cleveland, Denver, Pittsburgh, Portland, San Francisco, and Washington, D.C.

The peer utilities provide a variety of services to their regions. One of the peer utilities (San Francisco) manages drinking water, wastewater, and stormwater; one (Washington, D.C.) manages drinking water and wastewater; one (Cleveland) manages wastewater and stormwater; the remaining three (Denver, Pittsburgh, and Portland) only manage wastewater.

Three of the six peer utilities are currently subject to a consent decree with the EPA, as shown in Table 4. A consent decree is a court order that establishes an enforceable plan to which the parties have agreed. It may, for example, mandate the installation of system improvements to prevent or reduce combined sewer overflows. Each decree is different and may affect the peer utility's ability and willingness to conduct various climate readiness activities. The District is currently not subject to a consent decree.

Table 4: Consent Decree Status of Peer Utilities	
Peer Utility	**Consent Decree Status**
Cleveland	2010 decree with Northeast Ohio Regional Sewer District (covers Cleveland and surrounding communities) requires green infrastructure capture of 44 million gallons per year that would otherwise be discharged in a combined sewer overflow; utility must evaluate co-benefits of green infrastructure related to climate change
Denver	None
Milwaukee (District)	None, but the District's WPDES permit establishes requirements for wet weather management and goals for green infrastructure detention volume
Pittsburgh	2007 decree with Allegheny County Sanitary Authority (ALCOSAN) contains no mention of climate change or green infrastructure
Portland	None
San Francisco	None
Washington, D.C.	2016 modification to 2005 consent decree includes allowable list of green infrastructure practices to achieve combined sewer overflow reductions

The six peer utilities have undertaken climate readiness, mitigation, and adaptation activities in several broad categories, including physical system improvements, energy data acquisition and management, energy generation, carbon emissions reduction goals, materials management and beneficial reuse, broad incentives for green infrastructure installation, advanced water re-use, and parallel actions by the host municipality. These activities are summarized below.

Physical system improvements. Some of the peer utilities are constructing physical system improvements or "hard" assets including new facilities to increase treatment capacity, new pipes to reroute flow, or new inline storage elements that are directly responsive to climate change threats. For example, Cleveland plans to build a tunnel system to prevent billions of gallons of stormwater from entering Lake Erie, and to significantly reduce combined sewer overflows. Pittsburgh's regional authority, ALCOSAN, is doubling the capacity of its treatment plant to reduce wet weather overflows. DC Water is undertaking a $2.7 billion "Clean Rivers

Project," including a massive underground tunnel system, to reduce combined sewer overflows.

Notably, some of these improvements—such as Cleveland's, Washington D.C.'s, and Pittsburgh's—appear to have been undertaken because they are mandated by legally binding consent decrees. Others, such as San Francisco's multi-phase, 20-year "Sewer System Improvement Program" have been voluntarily undertaken.

Energy data acquisition and management. Most of the peer utilities—including Cleveland and Denver—have implemented some form of energy data acquisition and management systems. Cleveland, for instance, has established an energy use baseline and prepares regular reports to track use and efficiency improvements. Denver has also studied its energy consumption and intensity of use. San Francisco maintains detailed carbon emissions data that is searchable and sortable by each department of city government, including the agency responsible for wastewater treatment. Each city agency, including the San Francisco Public Utilities Commission responsible for wastewater treatment, must also file an annual report on its climate action initiatives.

Denver's Metropolitan Water Reclamation District also commissioned the development of a greenhouse gas (GHG) Emissions Inventory Tool to provide the District with a means to quantify the emissions associated with the annual operations of its facilities and a summary of its baseline emissions inventory. The tool also allows the District to evaluate the potential emissions impacts of process changes or equipment replacements. Early conclusions indicate that the District emits about 2.2 metric tons of carbon equivalents (CO2e) per million gallons of wastewater treated, or about 0.06 metric tons CO2e per person per year.

Energy generation. A recent study concluded that municipal wastewater treatment accounts for 3-4% of the total United States energy demand. (Shen, 2015). Energy consumption is often the highest cost for utility operators; on average, it represents over 30% of the total operation and maintenance costs for a treatment facility and accounts for up to 80% of greenhouse gas emissions. (Shen, 2015). It is no surprise, then, that more treatment facilities are attempting to become "energy neutral," especially among the leaders in responding to potential climate change impacts.

Denver is a leader in energy generation efforts. It successfully rerouted major collection pipes to capture the heat they emit for energy generation projects. In total, its heat recapture practices save it about $1 million per year on its energy costs. Denver also reuses methane, a byproduct of its solids processing operations, to generate enough energy to provide about 30-40% of the electricity necessary to operate its primary treatment facility.

DC Water uses the first North American thermal hydrolysis process, producing 13 megawatts of electricity and saving the utility about $10 million annually. The process involves converting biosolids into methane through a pressure cooking process. The methane is cleaned and then sent through turbines for energy and heat production.

Similarly, Portland re-uses biogas to generate about 40% of electrical needs at one of its wastewater treatment facilities.

Carbon emissions reduction goals. Water reclamation and energy usage (and as a result, carbon emissions) are deeply intertwined. Most of the peer utilities have committed to reducing carbon emissions as part of a broader host city plan although at least one has committed to do so on its own initiative. The goals may include emissions reductions by a given percentage over a given time period, or the purchase of a given percentage of electricity from renewable sources. These include the following:

- DC Water: 20% target reduction in greenhouse gas emissions from 2008 baseline; use "green energy" for 25% of load (Holman, 2016).
- Denver: Numerous different goals have been established by the city of Denver, the county of Denver, and the state of Colorado (Denver MWRD 2017).
- Pittsburgh: Pittsburgh's Climate Action Plan sets a citywide greenhouse gas emissions reduction goal of 80% below 2003 levels by 2050, with interim reductions goals of 20% below 2003 levels by 2023 and 50% below 2003 levels by 2030 (Pittsburgh, n.d.).
- Portland: The City of Portland (of which the environmental services division, responsible for wastewater treatment, is a part) has committed to transition to 100% clean energy by 2050; the broader region has established goals of a 40% emissions reduction by 2030 and an 80% reduction by 2050 (Portland 2015).
- San Francisco: Public Utilities Commission (responsible for wastewater treatment) has been an active supporter of the city's climate action efforts and has expressly adopted the citywide GHG emission reduction targets of 25% below 1990 levels by 2017, 40% by 2025, and 80% by 2050 (SF Public Utilities Commission 2014).

Some of the utilities, including DC Water and Denver, measure the amount of carbon reductions made possible by existing and proposed projects. For example, DC Water's thermal hydrolysis process has reduced carbon emissions by approximately 50,000 metric tons per year of carbon equivalents (CO2e).

By comparison, the District has committed to reduce its carbon footprint by 90% from baseline conditions by 2035 while meeting a net 100% of the District's energy needs with renewable sources.

Materials management and beneficial reuse. The peer utilities have implemented measures to better manage the byproducts of the water reclamation process. For example, Cleveland has focused on the beneficial reuse of biosolid incinerator ash. Portland recycles biosolids through land application to help restore vegetation and increase soil fertility. Portland also uses methane to create renewable natural gas that will be used to power vehicles in the City's fleet.

Broad incentives for green infrastructure installation. Several of the peer utilities have made broad commitments to incentivizing the installation of green infrastructure. The Pittsburgh Water Sewer Authority (not the regional authority) has conducted a study to assess the potential for green infrastructure to improve water quality and has implemented a city-wide "Green First Plan" (conducted in partnership with the regional ALCOSAN) to reduce combined sewer overflows through a combination of green infrastructure and other methods. For a time, the city also awarded green infrastructure grant funds to entities undertaking green infrastructure projects in the city.

The city and county of Denver have attempted to incorporate both large-scale and site-scale green infrastructure projects into its broader long-term stormwater management strategies. The region's "Green Infrastructure Implementation Strategy" envisions both water quality and flow improvements targeted to areas of the region where they are most needed, though (unlike the District's plan) it does not appear to set specific goals for water capture amounts.

DC Water has been awarded a grant from Harvard University to develop an innovative financing model for green infrastructure. It ultimately settled on an environmental impact bond program to finance the installation of 20 equivalent impervious acres of green infrastructure. The utility also proposed a massive green infrastructure project that would cover 50 acres of the Potomac and Rock Creek sewersheds at a cost of $10-$30 million. Under a modified consent decree arrangement, these green infrastructure practices, among other measures, will reduce combined sewer overflow volumes by 96% system wide.

While the District itself owns only a few green infrastructure projects, such as the green roof on its headquarters building, it has made significant efforts to encourage the implementation of green infrastructure projects throughout the region.

Advanced water re-use. Unsurprisingly, the western peer utilities (San Francisco and Denver) are the only two that have active water reuse programs. Denver's

"water recycling" facility treats and delivers billions of gallons of "reused" water each year for industrial and outdoor irrigation uses.

Parallel actions by host municipality. Many of the peer utilities are situated in communities that are similarly inclined to take responsive action to climate change. For example, the mayors of all six peer utility cities joined the "Climate Mayors" coalition, also known as the Mayors National Climate Action Agenda, a coalition of municipal leaders committed to honoring the goals and targets of the Paris Climate Accord. The City of Pittsburgh has also created a citywide "Climate Action Plan" that focuses in part on water: it targets a 50% reduction in sewer volumes by 2030 as compared to 2013 levels, to be accomplished by implementing green infrastructure and preventing stormwater from entering the system. The City of San Francisco is a leader on numerous fronts, having created a "Climate Action Program" with sustainability goals including zero waste and 100% renewable energy by 2030. In many cases, the wastewater utility is subject to or has agreed to adopt the municipal targets.

Table 5 summarizes these broad trends related to climate readiness efforts at the six peer utilities, based on publicly available material. As noted in Section 5 of this report, the District should consider gap-filling strategies where its efforts have fallen behind those of the peer utilities.

	Table 5: Major Mitigation and Adaptation Activity Trends at Peer Utilities						
Activity	Cleveland	Denver	Milwaukee (District)	Pittsburgh	Portland	San Francisco	Washington, D.C.
Physical system improvements	x			x		x	x
Energy data acquisition and management	x	x				x	
Energy generation		x	x		x		x
Carbon emissions reduction goals		x	x	x	x	x	
Materials management and beneficial reuse	x		x		x		x
Broad incentives for green infrastructure installation		x	x	x		x	x
Advanced water reuse		x				x	
Parallel action by host municipality	x	x	x	x	x	x	x

Overcoming Potential Legal Barriers to Local Climate Actions

The District's operations are directly affected by climate change impacts, so it has made the decision to mitigate climate risks to protect its facilities and operational capacity based on local climatic conditions. The District's statutory mandate is set out in Chapter 200 of the Wisconsin Statutes, with specific powers and duties enumerated in Wis. Stat. § 200.11. Yet none of the specifically enumerated powers Chapter 200 explicitly relate to climate change. While the District's duties generally relate to "sewerage collection and treatment" under this state authority, it also operates within the confines of the federal Clean Water Act (Act).

As a result of the lack of specific direction to mitigate climate change in Chapter 200 or under the Act, some of the District's member communities may express concern that implementing aggressive climate readiness actions could go beyond the District's statutory authority or beyond the confines of the Act, requiring unnecessary financial expenditures and other resource commitments. To mitigate any such risk, the District should emphasize local conditions and need for the actions being taken. In this respect, given its extensive study of and work in this area, the District has unique knowledge of local climate threats and is predisposed to implement climate mitigation tactics to guard against foreseeable local harms. The Act and case law demonstrate that local and state authorities have flexibility to operationalize more stringent requirements. In short, compliance with the Act in the face of a changing climate likely requires engaging in proactive responses.

On its face, the Act does not preclude states or programs from adopting or enforcing requirements, or implementing programs, beyond what the federal government has imposed. On the contrary, the Act states: "nothing in this part precludes a State from adopting or enforcing requirements which are more stringent or from operating a program with greater scope, than required under this part." 33 USCA § 1342 (s)(6)(A). This is in keeping with the broader purpose of the Act, to "recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources. . . ." 33 U.S.C. § 1251(b). This is also evident from the actions taken by the six peer utilities, as discussed in the last section. All have gone well beyond what would have been directly required by the Act.

The Act explains that federal agencies are to cooperate and collaborate with State and local agencies. Specifically, "federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources." 33 U.S.C. § 1251(g). The District has extensive knowledge and ability to address local climate risks given its familiarity with the local area, its geographic operations, and

its previous study of local socio-economic climate change risks as detailed in the 2019 Resilience Plan.

Case law interpreting the Act reinforces this, construing the statute as authorizing additional local requirements beyond those required by federal law. The Wisconsin Supreme Court explained that the Act articulates Congress' policy "to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution." *Andersen v. Dep't of Nat. Res.*, 2011 WI 19, ¶ 26, 332 Wis. 2d 41, 55, 796 N.W.2d 1, 8. Additionally, the court reiterated that the United States Supreme Court envisions a partnership between the states and the federal government. *Id*.

The Act itself also acknowledges that states may impose more stringent pollutant discharge limitations to meet the water quality standards of a particular body of water, or in the context of a particular geographic area. *See* § 1311(b)(1)(C). The District has forecasted the impact of predicted increased rainfall and has planned goals and actions to address this issue.

Similarly, federal courts have explained that Congress intended that NPDES permit writers would have the flexibility to include site-specific permit conditions such as the green infrastructure goals expressed in the District's permit. *Natural Resources Defense Council, Inc. v. Cnty. of Los Angeles*, 725 F.3d 1194, 1204 (9th Cir. 2013). These conditions can address the wide range of impacts associated with discharges. *Id*. "[C]ongress recognized that permit requirements for municipal separate storm sewer systems should be developed in a flexible manner to allow site-specific permit conditions to reflect the wide range of impacts that can be associated with these discharges." *Id.* Also, the EPA acknowledges that state authorities may issue permits to draft site-specific rules. As noted, the District's permit contains specific targets for wet weather management and for green infrastructure implementation, a climate readiness measure.

This too is in accord with federal court decisions:

> "Any water quality requirements established under State law, more stringent than those requirements established under State law, more stringent than those requirements established under the Clean Water Act also shall through certification become conditions of any Federal license or permit."

Monongahela Power Co. v. Marsh, 809 F.2d 41 (D.C. Cir. 1987).

Additional terms that the District negotiates with the Wisconsin Department of Natural Resources (WDNR) and then implements may function as conditions to its permit. These might come in the form of management practices, control techniques and system, or design and engineering methods.

The Act requires the permitting authority (here, the WDNR) to ensure that the permits it issues assures compliance with the Act's requirements. 33 U.S.C. § 1342(a)(1). As to municipal systems specifically,

> "Congress required municipal storm-sewer discharges 'to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator. . . determines appropriate for the control of such pollutants.'"

Defenders of Wildlife v. Browner, 191 F.3d 1159, 1165 (9th Cir. 1999) (citing 33 U.S.C. § 1342(p)(3)(B)(iii)).

The implementation of additional requirements beyond those mandated by the Act matches the statute's purpose and prior judicial interpretations of the Act. Additional requirements assist localities in effectively acting to prevent foreseeable harm as a result of climate change. The Act implicitly and explicitly grants authority to local authorities to determine what additional requirements or conditions are needed. For example, the District's climate mitigation goals that guard against negative impacts on Wisconsin land and health consequences such as access to clean drinking water.

Throughout this report, proposed climate change mitigation tactics may require requirements beyond those explicitly mandated by the Act. However, these requirements are understood to be in accordance with the purpose and prior interpretations of the Act.

5 Recommendations

Implementing the following recommendations will help the District maintain a leadership position among its peer group and accomplish the ambitious goals set out in the 2019 Climate Policy statement.

Evaluate energy usage and carbon emissions, and develop strategies to incorporate energy efficiency into operational, planning, and procurement decisions. Energy efficiency and usage affects the District's climate readiness and its financial stability and should be a clear and substantial factor in selecting District projects, alternatives, and consultants. The District should evaluate the activities undertaken by its peer utilities and consider whether it should implement similar initiatives. Most prominently, almost all the other utilities have taken measures to estimate their carbon emissions and improve energy efficiency. Doing so is also consistent with the EPA's "Adaptive Response Framework for Drinking Water and Water Utilities."

The District has some ground to make up in these areas. The District has not published estimates of its carbon emissions for almost a decade. District staff reported room for improvement in connecting the District's broadly expressed energy efficiency goals with individual project scope, design, equipment procurement and operational decisions. The District should strongly consider steps to systematically define and communicate strategic long-term, interim and short-term energy targets to divisions, departments and individual staff; and to better define how individual projects and initiatives can move the District closer to achieving the goals expressed in the District's 2035 Vision.

SUMMARY OF RECOMMENDATIONS

- Evaluate energy usage and carbon emissions, and develop strategies to incorporate energy efficiency into operational, planning, and procurement decisions
- Implement selected projects recommended in the 2014 Vulnerability Analysis
- Continue existing initiatives in green infrastructure and methane-to-energy programs
- Implement and integrate recommendations from the District's 2019 Resilience Plan
- Conduct periodic reviews of the District's climate policies

Staff suggested the development of a system-wide strategic approach that could set clear organizational targets for energy goals, data availability, accounting methods and standards. The District should also track performance and results after completion of a project or initiative to determine how well the chosen methods achieved energy goals. This combined approach should also create a clear path with

intermediate steps to completion that can be translated to quantitative energy goals for individual projects and organizational levels.

To remedy these comparative gaps and to further operationalize its climate vision, the District should update its carbon emissions inventory; it should document and update its energy usage levels; and it should incorporate the broad energy efficiency strategy described above. Obtaining these data is expected under the District's Scope 5 initiative and would allow the District to reassess its goals for energy efficiency improvements and year-over-year carbon emissions reductions, as many of the other peer utilities have done. To date, the District has expressed twin goals of 90% emissions reductions from baseline conditions by 2035, and complete energy self-sufficiency (self-generation) by 2035.

The District is already making progress on these recommendations. For example, the District's Scope 5 program will provide an energy and carbon emissions inventory on a regular basis. The District also uses a wastewater treatment data management system, Hach WIMS, to document and collect data on energy usage. And the District is currently navigating the best way to integrate energy efficiency considerations into the procurement process, perhaps by requiring a contractor to describe the energy efficiency of proposed equipment. While the District's Clean Water Fund Program design contracts contain a standard condition requiring "consideration" of energy efficiency, the certification is relatively ambiguous and more specifics would support project managers alignment of goals, as described above.

For example, the District should consider the place of energy efficiency in a hierarchy of other factors such as reliability, ease of operations, proven experience, and cost. With respect to cost, the District might direct designers or contractors that full life cycle expenditures should be considered rather than up-front or capital costs alone. A corresponding measure would be to require a follow-up report to completed projects documenting energy efficiency achievements and providing constructive feedback and guidance for future projects.

Further, the District's 2015 "Final Energy Plan" identified gaps between existing energy uses and the 2035 goals and identified 15 priority projects to bridge the gap, suggested for initiation between 2015-2020. Examination of the specific projects is beyond the scope of this report, but generally, the projects were expected to significantly decrease the District's energy demand while simultaneously increasing renewable energy production. According to District staff, several of the projects have been implemented to a varying degree of completion. The issue is expected to be further studied as part of the District's 2050 Facilities Plan.

The 2015 Final Energy Plan also established an energy baseline to track progress against goals for calendar years 2005 and 2010. It is unclear whether any

of the 2035 goals should be adjusted given the current status of the recommended projects. The District could even evaluate its "emissions efficiency" against the statistics published for Denver (2.2 metric tons of carbon equivalents (CO2e) emitted per million gallons of wastewater treated, or about 0.06 metric tons CO2e per person per year).

The District could also explore increased integration of all energy efforts from planning, design, construction, and operations to create a better picture of the current situation and to optimize the impact of the District's future energy efficiency projects and efforts. To lead these efforts, the District might consider creating an energy director position to lead associated projects through planning, design, construction, and operation phases.

Implement selected projects recommended in the 2014 Vulnerability Analysis. Where the District has begun implementing the recommendations set out in the 2014 Vulnerability Analysis, it should continue those efforts. The District should also consider whether any of the activities rated "not started" by this report should be undertaken. As a starting point for this analysis, three projects identified with an asterisk (*) in Table 1 have not been started but should be considered for near-term initiation due to their responsiveness to high-risk climate impacts, and their direct alignment with the District's vision, with national readiness frameworks, and/or with the activities already undertaken by the District's peer utilities. The three projects are:

- Installing more energy efficient equipment as existing equipment is replaced and new equipment is installed, especially on larger projects;
- Developing a vegetation species mix for watercourse projects with consideration of acceptable performance under (a) warmer or drier future conditions and (b) salt tolerance; and
- Developing a vegetation species mix for green infrastructure projects with consideration of acceptable performance under (a) warmer or drier future conditions and (b) salt tolerance.

These potential projects have been selected to be both reasonable and scalable in scope, and to mesh well with the other recommendations in this section, including increased emphasis on energy efficiency and emissions management, continued widespread use of green infrastructure, and selection of vegetation that can tolerate warmer and drier environments.

Continue existing initiatives in green infrastructure and methane-to-energy programs. The District should continue implementing the innovative readiness practices it has developed outside the confines of the recommendations put forward in the 2014 Vulnerability Analysis. Specifically, these should include the District's current funding mechanisms and technical support programs to incentivize green

infrastructure. The District could even consider scaling up this program to identify green infrastructure installation opportunities on private property and in other areas not directly driven by the District. Since 2014, approximately 68% of projects are on public property and 32% of projects are on private property for projects funded by the District's match funding programs for green infrastructure construction.

Second, the District should continue and expand its energy production initiative using landfill gas to help power the Jones Island water reclamation facility and should continue negotiations with the landfill gas supplier. These projects, especially the energy generation project, align well with the District's strategic vision statements and are in many ways the best operational evidence of the District's ongoing commitment to climate readiness.

Implement and integrate recommendations from the District's 2019 Resilience Plan. The 2019 Resilience Plan provides a framework for how the Milwaukee metropolitan area can address complex risks to become a stronger, more resilient region. Climate change is a prominent factor in the Resilience Plan, and the District should incorporate the Resilience Plan's specific climate risk recommendations into its future planned expenditures. This includes the following actions recommended in the Resilience Plan:

- Action 3 (Engage stakeholders in collaborative decision making and implementation of watershed restoration and water quality plans);
- Action 4 (Accelerate local efforts to improve communities by replacing grey impervious surfaces with green spaces);
- Action 17 (Assess the reliability of critical infrastructure by performing a criticality analysis);
- Action 18 (Establish a policy review and response mechanism);
- Action 19 (Increase green infrastructure in the region); and
- Action 20 (Develop and implement a plan to make critical infrastructure around water systems cyber resistant).

Conduct periodic reviews of the District's climate policies. The District should institute periodic reviews of its climate policies. While it is difficult to specify a particular time frame, a review period of four to five years seems reasonable. This window will match up both with the five-year reissuance cycle of the District's WPDES permit, which now includes specifics related to wet weather management practices including green infrastructure and other measures that directly impact climate readiness. It also aligns fairly well with the quadrennial time cycle for the federal government's National Climate Assessment reporting process conducted by the U.S. Global Change Research Program, a collection of 13 federal agencies, and mandated by the Global Change Research Act of 1990.

6 Conclusion

The impacts of climate change will continue to challenge the operational and planning capacities of the District and other utilities. Designing and maintaining critical infrastructure under unknown conditions will be difficult and may require additional resources. Needed improvements should be evaluated and funded as appropriate in the annual budget process. Identifying and implementing recommendations moving forward based on the strategies outlined in this report will put the District in a better position to accomplish its ambitious goal to remain a leader among its peers in climate readiness, mitigation, and adaptation.

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APPENDICES

2035 VISION

The Milwaukee Metropolitan Sewerage District's 2035 Vision and Strategic Objectives

Revised December 16, 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.

(https://www.mmsd.com/what-we-do/green-infrastructure/green-luminaries)
Green Luminary® Award
(https://www.mmsd.com/what-we-do/green-infrastructure/green-luminaries)

(https://www.mmsd.com/what-we-do/wastewater-treatment/tours)
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History (https://www.mmsd.com/about-us/history)

Contact (https://www.mmsd.com/about-us/contact-us)

Milorganite (http://www.milorganite.com/)

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- (https://twitter.com/MMSD_MKE)
- (https://www.instagram.com/MMSD_MKE)

Item 22

COMMISSION FILE NO: 19-113-7 **DATE INTRODUCED:** July 8, 2019

INTRODUCED BY: Executive Director

REFERRED BY COMMISSION CHAIRPERSON TO: Policy, Finance, and Personnel Committee

RELATING TO: Adoption of Commission Policy 1-11.06, Climate Change Adaptation

SUMMARY:

The Commission is requested to adopt the attached proposed Commission Policy 1-11.06, Climate Change Adaptation (Policy). The proposed Policy recognizes the extensive body of scientific research concluding that climate change is already responsible for significant impact in the State of Wisconsin and is expected to deliver even more severe consequences in the future. The Policy provides that the Milwaukee Metropolitan Sewerage District (District) must account for climate change's effects in operations and planning; it further outlines and confirms the District's commitment to utilize renewable energy sources whenever feasible in accord with the Wisconsin State Energy Policy, Wis. Stat. sec. 1.12; and it drives the District to continue to develop and use increasingly efficient technologies to carry out its statutory duties to provide water reclamation, stormwater management, and flood management services to all the communities in its service area.

The proposed Policy reaffirms and builds on the District's prior sustainability efforts, such as the Environmental Sustainability Policy, the 2035 Vision, the Sustainability Plan, the Climate Change Vulnerability Analysis, and the Greenseams® and Green Infrastructure programs.

ATTACHMENTS: **BACKGROUND** ☒ **KEY ISSUES** ☐ **RESOLUTION** ☒
FISCAL NOTE ☐ **S/W/MBE** ☐ **OTHER** ☒ Climate Change Adaptation Policy: Background; Proposed Commission Policy 1-11.06

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COMMITTEE ACTION: _____ **DATE:** _____

COMMISSION ACTION: _____ **DATE:** _____

BACKGROUND

Adoption of Commission Policy 1-11.06, Climate Change Adaptation

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NASA defines climate change as a broad range of global phenomena caused predominantly by the burning of fossil fuels that adds heat trapping gases to Earth's atmosphere. The District continuously leads in incorporating energy conservation and efficiency to combat the effects of climate change in its water treatment, stormwater management, and flood control capacities. With the proposed policy, the District recognizes the urgency of the substantial effects of climate change on its operations and ratifies its commitment to (1) developing and using renewable energy whenever feasible; (2) designing and implementing innovative and cost effective technology; and (3) undertaking continuous reassessment of strategies to adapt to and mitigate the immediate and long-term deleterious effects resulting from climate change.

Climate change is predicted to inflict significant burdens on water treatment facilities particularly in the Midwest and Great Lakes region. Precipitation events will likely be more volatile, with larger precipitation events predicted to be more intense and smaller ones to be both less frequent and less substantial. As the average temperatures increase, so too will the occurrence of heat waves, and more precipitation is expected to fall as rain rather than snow during the winter. Overall, climate change will present an increasing operational challenge stemming from this variability in the influent stream, putting further strain on aging and deteriorating water treatment infrastructure, facilities, and processes. In the face of these challenges, adoption of the proposed policy represents a necessary part of the cadre of MMSD's actions responding to climate change attentive to its staff, ratepayers, and the environment.

RESOLUTION

Adoption of Commission Policy 1-11.06, Climate Change Adaptation

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RESOLVED, by the Milwaukee Metropolitan Sewerage Commission, that the attached Commission Policy 1-11.06, Climate Change Adaptation, is adopted.

Climate Change Adaptation Policy: Background

The Climate Change Adaptation Policy Builds on Prior District Efforts to Adapt to and Mitigate Climate Change

Although mainstream recognition of climate change's effects has become widespread, MMSD would be among the first agencies of its kind to adopt a policy acknowledging the need to account for climate change impact in operations and planning decisions, and implementing an official blueprint of principles and strategies to address the issue. This Policy adoption builds on the progress MMSD has already achieved and planned:

1. **Environmental Sustainability Policy**. Adopted by the MMSD Commission in 2005, the Environmental Sustainability Policy cemented the District's commitment to act as an environmental steward for the Greater Milwaukee Watersheds.[1]

2. **2035 Vision.** Revised in 2010, the 2035 Vision for MMSD is grounded in two principal elements: (1) integrated watershed management and (2) climate change mitigation and adaptation, emphasizing energy efficiency.[2] The Vision sets an ambitious but achievable goal of zero overflows, zero basement backups, and improved stormwater management.[3]

3. **Sustainability Plan**. In 2012, the District released its comprehensive Sustainability Plan.[4] The plan builds on MMSD's sustainable past as it outlines how it continues to lead the way in innovative technology to reduce the impact of operating an energy-intensive and vital service like water reclamation using grey and green infrastructure and watershed-level planning.[5]

4. **Climate Change Vulnerability Analysis**. In 2014, the District undertook a climate change vulnerability analysis as part of a coordinated risk management approach to climate adaptation.[6] The trifold objectives of that analysis were: (1) to provide information useful to the District to decide capital improvements and operational strategies; (2) to assess the timeframe of climate change's effects crossing thresholds for threats to facilities and operations; and (3) to quantify risks in order to develop adaptation strategies.[7]

5. **Energy Recovery**. The District has, since 1975, used anaerobic digesters to capture biogas at the South Shore Water Reclamation Facility to burn as fuel to generate electricity.[8] Since the 1920s, the District has used the waste heat produced by generators at Jones Island to dry Milorganite® and heat the facility's buildings.[9] Additionally, the District has invested significant resources in the landfill gas project, allowing it to make beneficial use of previously wasted landfill gas by burning it in generators to produce electricity.[10] Finally, the District generates electricity using solar panels installed at various sites including its headquarters.

6. **GreenSeams® and Green Infrastructure®**. The twin programs both propel the District toward its goal of managing stormwater where it falls, but also achieve demonstrable carbon sequestration.[11] These simple and effective techniques reduce the amount of water in the District's grey infrastructure, resulting in less energy expended by the District to treat stormwater runoff.

All of these proactive measures are consistent with the Climate Change Adaptation Policy now recommended for approval. Adoption of this Policy will be a clear statement of the Commission's intent to continue taking action to adapt to and mitigate the impact of climate change.

The Science: Greenhouse Gas Emissions, Mostly Carbon Dioxide, Are Causing Climate Change

In May 2019, the carbon dioxide concentration in Earth's atmosphere measured at the Mauna Loa Observatory reached the highest level in human history.[12] The record 415 ppm means that 415 of every one million gas molecules in the atmosphere were carbon dioxide. Carbon dioxide (CO_2) is a greenhouse gas; it traps heat in the atmosphere.[13] CO_2 is injected into the atmosphere by burning fossil fuels (like coal, natural gas, and oil), solid waste, or biological materials (like trees).[14] Carbon dioxide is removed from the atmosphere ("sequestered") in another phase of the biological carbon cycle when plants absorb it.[15] Carbon dioxide is "the most important of the long-lived greenhouse gases responsible for Earth's natural greenhouse effect."[16] Additional amounts of it in the atmosphere since the Industrial Revolution have warmed the planet and acidified the oceans.[17]

International consensus acknowledges the mounting concern for the effects of climate change.[18] Indeed, today, representatives from all sectors—scientists, lawmakers, activists, and industry executives—recognize that immediate action is required.[19] The United Nations maintains that water is "the primary medium through which we will feel the effects of climate change."[20] The Great Lakes Region, in part because of its concentration of aging, polluting coal plants and its position at the country's transportation crossroads, is at the heart of the carbon pollution problems.[21] As the global temperature is expected to rise between 2 to 5 degrees celcius within the next thirty years, water treatment processes will face special challenges, including inundated water supplies leading to higher levels of contamination, increased pressure on current water infrastructure's operation, and the effect that more frequent inclement weather like increased precipitation will have on existing processes and infrastructure.[22] MMSD has been a faithful proponent of adaptation and mitigation to avert effects associated with a changing climate, and it has solidified those commitments to future generations by grounding its planning and sustainability directives in them—from the District's 2035 Vision to its 2050 Facilities Plan. So that MMSD may continue to provide the strong leadership needed to combat climate change's destructive effects, the Commission is requested to adopt the Climate Change Adaptation Policy.

Climate Change Will Continue to Affect Water Reclamation Providers Like MMSD

The quantity and quality of water available for use by both people and ecosystems nationally are markedly affected by climate change, "increasing risks and costs to agriculture, energy production, industry, recreation, and the environment."[23] In the Midwest, climate change will have a distinct and significant impact on water resources and, consequently, on water resources management.

Warmer. The Midwest is predicted to be warmer overall, which is anticipated to bring several consequences.[24] First, there will likely be more rainfall in winter and late spring and potentially less rainfall in late summer and fall, leading to more extreme droughts.[25] Generally, that will spell lower base flows in surface waters and lower reservoir levels in the summer and fall months.[26] Reduced summer rainfall and increased evaporation will likely curtail groundwater recharge, cause small streams to run dry, and pare back wetlands, which, in turn, will all contribute to poorer water quality and less wildlife habitat.[27] Second, watershed and aquifer recharge area vegetation is expected to change, disrupting the recharge of groundwater aquifers and the quantity and quality of runoff into surface waters.[28] Third, water temperatures are expected to increase, resulting in increased evaporation and eutrophication in surface sources and presenting challenges for water treatment and distribution.[29] Finally, demand for water is expected to increase; specifically, demand in urban areas will likely increase during drought periods.[30]

Wetter. More intense rainfall events are predicted for the Midwest as a result of a changing climate, with two likely repercussions.[31] First, turbidity (higher level of total suspended solids) and sedimentation (the process of settling) will likely increase, causing loss of reservoir storage and presenting water filtration challenges.[32] The frequency of heavy rainstorms lasting a day or longer is anticipated to increase, perhaps 50-100% higher than at present.[33] Although annual average precipitation may not significantly change, Wisconsin may actually grow drier overall, as the rainfall fails to compensate for the drying effects of a warmer climate, which will be especially true in summer.[34] Wisconsin municipalities will have to upgrade their water infrastructure including levees, sewer pipes, and wastewater treatment plants in anticipation of these more frequent extreme downpours and floods.[35] Finally, infectious diseases—from cryptosporidiosis, with which Milwaukee is all-too familiar, to Lyme and West Nile encephalitis—may become more frequent or widespread as increased precipitation and temperatures could both overwhelm municipal systems and encourage greater reproduction or survival of disease-carrying insects.[36]

Water reclamation facilities like MMSD shoulder the brunt of the climate change impact on our water even as they bear the indispensible responsibility of managing storm and floodwater and returning service area water at a quality meeting regulatory standards. Broadly, research has revealed several categories of climate change impact that will be especially detrimental to wastewater treatment operations, including: (1) increased risk of plants and facilities flooding; (2) changes in receiving water quality; (3) challenges to collection and conveyance system operations; and (4) challenges to wastewater treatment, biosolids, and reuse operations.[37] For these reasons, it is directly practical that the District adopt the Climate Change Adaptation Policy.

The Climate Change Adaptation Policy Acknowledges and Incorporates the Wisconsin Law that Sets out the State Energy Policy

In addition to the practical benefit, MMSD's adoption of this Climate Change Adaptation Policy would harmonize the District's implemented and future efforts at climate change mitigation and adaptation with required objectives set out in state law. Wisconsin statutes declare the State Energy Policy, goals, and priorities, which are incumbent upon the District as a local governmental unit. First, the State's Energy Policy requires that local governmental units "investigate and consider the maximum conservation of energy resources as an important factor when making any major decision that would significantly affect energy usage."[38] Second, the law establishes a state goal that "to the extent that it is cost-effective and technically feasible, all new installed capacity for electric generation in the state be based on renewable energy resources, including hydroelectric, wood, wind, solar, refuse, agricultural and biomass energy resources."[39] Third, the State Policy, to the extent cost-effective and technically feasible, is that options are to be considered based on the ordered priorities: (1) energy conservation and efficiency; (2) noncombustible renewable energy resources; (3) combustible renewable energy resources; (4) advanced nuclear energy; (5) nonrenewable combustible energy resources.[40] Finally, the statute requires local governmental units to rely to the greatest extent feasible on energy efficiency improvements and renewable energy resources in designing all new and replacement energy projects, as long as cost-effective, technically feasible, and without unacceptable environmental impacts.[41] Adoption of this Climate Change Adaptation Policy provides needed guidance and sets a reliable benchmark to inform the District's decision-making in compliance with Wisconsin law.

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Commission Policy

Title:	Climate Change Adaptation	Policy #: 1-11.06 Page: 1 of 2
Authority	Statute: Wis. Stat. § 1.12 (Wisconsin Energy Policy) Resolution: 19-113-7	Date Issued: 7/22/2019 Date Revised:

In furtherance of (a) the directives in the Wisconsin State Energy Policy, Wis. Stat. § 1.12, to consider the maximum conservation of energy resources when making any major decision that would significantly affect energy usage and to use renewable energy resources whenever possible; and (b) its statutory mission under Wis. Stat. Ch. 200 Subch. II to provide water reclamation, stormwater management and flood management services for all of the communities in its service area in face of an increasingly warmer and wetter climate, MMSD commits to advancing the following objectives:

1. Energy

a. Reduce greenhouse gas emissions by using renewable sources of energy whenever feasible, in line with current efforts like the landfill gas project and solar power generation at Jones Island Water Reclamation Facility.

b. Reduce energy demand at MMSD facilities by implementing efficiency measures like low-flow toilets, power management systems for office equipment, and seasonally-calibrating thermostats whenever feasible.

c. Consistent with the Policy Direction Regarding the 2050 Facilities Plan, approved April 22, 2019, streamline energy use and continue to use energy from renewable sources where possible to achieve the Climate Change Mitigation/Adaptation Goals for 2035.

2. Technology

a. Identify and implement cutting edge technologies to achieve energy efficiency and security as well as sustainable design, e.g. sewage heat recovery, corrosion-resistant materials, algae and other biofuels, and GIS software.

b. Aggressively pursue MMSD's twin goals of integrated water management and climate change mitigation and adaptation as established in the 2035 Vision.

c. Expand green infrastructure development and use throughout MMSD's service area to reduce combined and sanitary sewer overflows and pumping and related energy costs by capturing precipitation where it falls.

d. Prevent waste and recapture loss in the sewer system.

Commission Policy

Title:	Climate Change Adaptation	Policy #: 1-11.06 Page: 2 of 2
Authority	Statute: Wis. Stat. § 1.12 (Wisconsin Energy Policy) Resolution: 19-113-7	Date Issued: 7/22/2019 Date Revised:

3. Information

a. Foster collaborative partnerships with public and private sector stakeholders as well as land use planning authorities to assess cooperative, watershed-scale opportunities for adaptation in light of MMSD's 2014 Climate Change Vulnerability Analysis.

b. Invest and engage in public education to build a broad coalition of stakeholders, raise awareness of climate change's negative effects, and empower individuals to reduce their carbon footprint.

c. Prioritize monitoring of local indicators of climate change and related research, including watershed monitoring and modeling, to anticipate critical thresholds for climate change related impact.

d. Continuously evaluate the efficacy of implemented technological solutions and conduct institutional-level reassessment and analysis to determine appropriate short- and long-term responses to changing climatic challenges.

e. Invest and engage in research relevant to climate change affecting MMSD's work and facilities, including regular updating of vulnerability analysis; undertaking adaptation analysis; and reviewing and updating emergency plans.