FINAL REPORT | July 2021

WATER/SEWER SERVICES COMPREHENSIVE BUSINESS PROCESS REVIEW

Baltimore County and Baltimore City

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July 12, 2021

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Christopher J. Shorter
Chief Administrative Officer
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Baltimore, MD 21202

Subject: Water / Sewer Services Comprehensive Business Process Review - Report

Dear Ms. Rodgers and Mr. Shorter,

It has been our privilege and honor to conduct the study that is represented by the Executive Summary and six tasks of this report. We must acknowledge the cooperation and interest of the various individuals and organizations within the County and City which provided the data upon which our findings, conclusions and observations rest. This was accomplished despite the severe limitation on personal "face-to-face" meetings and interviews attributable to the current pandemic. We must also acknowledge our project partners (Cozen O'Conner, PEER Consultants, and Momentum), whose contributions were invaluable.

The Baltimore Region has been blessed with an ample supply of good-quality water to support everyday life and commerce. With that beneficence comes a requirement for stewardship that requires close coordination of the management and operational processes that are needed for sustainability. It is clear that there is a need for improvement in existing processes and relationships. It took a century of interaction for the water and wastewater system's management to arrive at its current situation, and any improvements will take several years to implement carefully.

We would be pleased to meet with you to present the results of this study.

Very truly yours,

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Acronyms and Abbreviations

ACSA	Albemarle County Service Authority
AM	City Administrative Manual
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
AMS	Asset Management System
AMWA	Association of Metropolitan Water Agencies
ANSI	American National Standards Institute
APA	American Planning Association
AWWA	American Water Works Association
AWWA M3	*M3 Safety Management for Utilities*
AWWA M36	*M36 Water Audits and Loss Control Programs*
AWWA M60	*M60 Drought Preparedness and Response*
BBMR	Bureau of the Budget and Management Research

BCDOT	Baltimore City Department of Transportation
BCIT	Baltimore City Office of Information & Technology
BEC	County Bureau of Engineering & Construction
BH20	Baltimore Water Customer Assistance Program
BIA	Business Impact Analysis
BMC	Baltimore Metropolitan Council
BMP	Best Management Practice
BOD5	biological oxygen demand
BOE	City Board of Estimates
BOU	County Bureau of Utilities
BRPC	Blue Plains Regional Committee
BWW	City Bureau of Water and Wastewater
CAM	Cost Allocation Model
CAO	Chief Administrative Officer
CARL	Current Annual Real Losses
CCTV	Closed-Circuit Television
CDC	Centers for Disease Control and Prevention
CDL	Commercial Driver's License
CFPUA	Cape Fear Public Utility Authority
CFR	Code of Federal Regulations
CHP	Chemical Hygiene Plan
CI	Continuous Improvement
CIP	Capital Improvement Program
CIS	Customer Information System
City	Baltimore City
COD	Chemical Oxygen Demand
COOP	Continuity of Operations
County	Baltimore County
CRM	Customer Relationship Management
CRSC	Chesapeake Region Safety Council
CSIS	Customer Service Information System
CSO	Combined System Overflow
CSR	Customer Service Representative
CSSD	City Customer Service & Support Division
CTI/CUI	Controlled Technical Information / Controlled Unclassified Information
CWA	Clean Water Act
CY	Calendar Year
DART	Days Away, Restricted or Transferred
DBA	Database Administration
DC WASA	District of Columbia Water and Sewer Authority or "DC Water"
DEQ	Department of Environmental Quality
DGS	City Department of General Services
DIP	Driver Improvement Program

DOF	City Department of Finance
DPW	Department of Public Works
DR	Disaster Recovery
DROP	Deferred Retirement Option Program
EAM	Enterprise Asset Management software
EMR	Experience Modification Rating
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ERT	Encoder Receiver Transmitter
EUM	Effective Utility Management
FCR	First Contact Resolution
FISMA	Federal Information Security Management Act
FMEA	Failure Mode and Effects Analysis
FOG	Fats, Oil and Grease
FTE	Full-Time Equivalent
FTP	File Transfer Protocol
FY	Fiscal Year
GAO	United States Government Accountability Office
GCMS	Gas Chromatography Mass Spectrometry
GHS	Globally Harmonized System
GIS	Geographic Information System
HAZCOM	Hazard Communication Standards
HR	Human Resources
HVAC	Heating, Ventilation and Air Conditioning
I/I	Inflow/Infiltration
ICMA	International City/County Management Association
ICP-MS	Inductively Coupled Mass Spectrometry
ID/IQ	Indefinite Delivery, Indefinite Quantity
IEC	International Electrotechnical Commission
IG	Inspector General
ILI	Infrastructure Leakage Index
IMA	Intermunicipal Agreement
IOU	Investor-Owned Utility
IPF	Integrated Planning Framework
ISCP	Information System Contingency Plan
ISO	International Organization for Standardization
IT	Information Technology
IWA	International Water Association
KPI	Key Performance Indicator
LMS	Laboratory Management System
LOS	Level of Service
LOTO	Lockout/Tagout
MAB	2019 California Multi-Agency CIP Benchmarking Study

MBE/WBE	Minority Business Enterprise/Women's Business Enterprise
MCD	Modified Consent Decree
MDC	Metropolitan District Commission
MDE	Maryland Department of the Environment
MEMA	Maryland Emergency Management Agency
Metro	County Metropolitan District Financing and Petitions Office
MGD	Million Gallons per Day
MOSH	Maryland Occupational Safety and Health
MOSS	Mayor's Office of Sustainable Solutions
MRP	Material requirements planning
MS4	Municipal Separate Storm Sewer System
MVRS	Itron Mobile Collector Reading Software
MV-RS	Multi Vendor Reading System
MWPAAC	Metropolitan Water Pollution Abatement Advisory Committee
MWRA	Massachusetts Water Resource Authority
NACWA	National Clean Water Association
NASSCO	National Association of Sewer Service Companies
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NPDES	National Pollutant Discharge Elimination System
NRF	National Response Framework
NSC	National Safety Council
O&M	Operations and Maintenance
OAM	City Office of Asset Management
OBF	County Office of Budget and Finance
OEC	City Office of Engineering and Construction
OFI	Opportunities For Improvement
OIG	WSSC Water Office of the Inspector General
OLAR	City Office of Legal and Regulatory Affairs
OLC	Baltimore City Office of the Labor Commissioner
OSAP	City Office of Strategy and Performance
OSHA	Occupational Safety and Health Administration
OST	City Office of Safety and Training
OT	Overtime
PAI	County Department of Permits, Approvals and Inspections
PandID	Process and Instrumentation Diagram
PCCP	Prestressed Concrete Cylinder Pipe
PE	Professional Engineer
PIA	Public Information Act
PM	Preventive Maintenance
PM&CI	Performance Management and Continuous Improvement

PMP	Performance Management Program
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
PSC	Public Service Commission
QA/QC	Quality Assurance/Quality Control
RCA	Root Cause Analysis
RCM	Reliability Centered Maintenance
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Quote
RWSA	Rivanna Water and Sewer Authority
SCADA	Supervisory Control and Data Acquisition
SDS	Safety Data Sheet
SIU	Significant Industrial User
SLA	Service Level Agreement
SOP	Standard Operating Procedure
SQL	Structured Query Language
SRBC	Susquehanna River Basin Commission
SSO	Sanitary Sewer Overflow
TCC	Total Construction Cost
Telog	Telemetry and Data Logging
TMDL	Total Maximum Daily Limit
UARL	Unavoidable Annual Real Losses
UMAX	Itineris UMAX Customer billing system
UMD	City Utility Maintenance Division
UOSA	Upper Occoquan Sewage Authority
UV/Vis	Ultraviolet/Visible Light Computer Interface
WAO	Water Analyzer Office
WARN	Water and Wastewater Agency Response Network
WBS	Work Breakdown Structure
WFD	City Water Facilities Division
WFP	Water Filtration Plant
WMIS	Water Management Information System
WO	Work Order
WSSC	Washington Suburban Sanitary Commission or "WSSC Water"
WWAO	Wastewater Analyzer Office
WWFD	City Wastewater Facilities Division
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

BACKGROUND

Baltimore City provides water and wastewater services to approximately 1.8 million people in Baltimore City, Baltimore County and portions of Anne Arundel, Carroll, Howard and Harford Counties. The system's service area of 220 square miles encompasses the entirety of Baltimore City and 140 square miles outside of the City's limits. The water system produces approximately 72.1 billion gallons of treated water annually. The City's two regional wastewater treatment facilities have the capacity to treat up to 250 million gallons of wastewater per day.

The water system provides potable water to City and County customers at retail rates and to Howard and Anne Arundel Counties on a wholesale basis. Harford and Carroll have agreements to purchase raw water from Baltimore City.

Since the passage of the Metropolitan District Act in 1924 (which obligated Baltimore City to provide water to certain areas of Baltimore County) and subsequent adoption of inter-jurisdictional agreements in the early 1970s, a complex relationship has evolved between the two jurisdictions. This relationship involves the planning, management, maintenance and funding of the shared facilities that make up the regional water and wastewater systems.

Leaders from Baltimore City and Baltimore County (the "Leadership Team") have developed a shared vision of creating the "Utility of the Future." To achieve this vision, the City and County desire to enhance the intergovernmental coordination and business processes and policies required to efficiently, effectively and sustainably provide customers with high-quality water and sewerage services.

As a first step toward achieving that vision, the City and County have jointly undertaken this comprehensive business process review. The review identifies the strengths and weaknesses of the current governance framework of the utilities. It also identifies potential opportunities to improve how the two jurisdictions work together to provide high-quality, affordable water and wastewater services.

The Leadership Team desires to understand the current state of the structures and processes involved with coordinating the delivery of water and wastewater services between the City and County. In light of these findings and observations, the Team would like the areas requiring further assessment and initiatives to enhance the overall system's efficiency and effectiveness identified.

The comprehensive business process review of the City/County water and wastewater system was organized into the following tasks:

- Task 1 – Evaluate City-County Existing Service Agreements for Water/Sewer Services
- Task 2 – Review the City and County Organizational Structure and Governance Models
- Task 3 – Review Staffing
- Task 4 – Evaluate Water and Sewer System Planning and Management
- Task 5 – Assess Meter to Cash Operations
- Task 6 – Review Field Operation

Per the project requirements, our review results in each of these functional task areas were documented in a series of standalone task reports and transmitted to the City and County under separate cover.

This executive summary presents a high-level overview of key findings and observations identified in all six task reports and summary conclusions and recommended next steps.

Project Approach

Our proposed approach to this business process review study consisted of four phases encompassing the programs and functional areas included in the project scope.

- Phase I – Preliminary Investigations: The project team makes initial contact and performs investigations to obtain a general understanding of how the organizations are structured, how they operate and how well they perform, as evidenced by operating and financial records.
- Phase II – On-Site Investigations: The project team performs on-site investigations of the organizations' management and the daily operation and support functions associated with their operations. Internal and external drivers are identified.
- Phase III – Functional Evaluations: The project team performs an assessment and evaluation of each of the management, support and operational functions of the organizations, identifying potential problem areas within the various functions.
- Phase IV – Report Preparation: The project team prepares an analysis report summarizing the findings of the functional evaluation.

Due to the ongoing impacts of COVID-19 (which limited the project team's ability to interact in-person with City and County staff, review information on-site and efficiently access documents and data), our project approach had to be substantially modified over the last several months. In place of in-person meetings, workshops and interviews with individual staff, we relied exclusively on a smaller number of virtual meetings conducted with multiple participants.

The project team submitted a substantial information request at the beginning of this project that consisted of historical documents and reports, much of which existed only as paper files in City and County offices. As most of the City and County staff that we relied on to respond to this information request were working remotely in the early phases of this project, their ability to search for, copy and transmit information electronically was greatly hampered. As a result, the data collection phases of this project took, in some cases, several months longer than anticipated.

As a result of these limitations and constraints, we relied heavily on the comments, insights, and perspectives gathered through staff interviews and surveys to fill in any gaps in data, reports and documentation. This is evident in cases where our findings and observations could not be independently confirmed with data analysis.

Finally, there have been several personnel changes since project initiation in April: the County Department of Public Works Director position, the City DPW Chief of Staff position, the City Utility Maintenance Chief position, the City Utility Billing Chief position and the City Meter Shop Chief position. The reader is cautioned that some findings and observations might not reflect current philosophies, processes or policies that have been changed as new people come on board.

Summary of Key Findings and Observations

Based on the Leadership Team's goals and objectives for the project, we have organized the major findings from each of the six task reports into three groups:

- **Operational** – These are key findings and observations related to the discrete operational areas identified in Tasks 4, 5 and 6.

- **Organizational** – These are key findings and observations related to how each jurisdiction is organized to provide utility services in the City and County and how these organizations are managed and staffed. These are primarily findings and observations that were developed during Tasks 2 and 3.
- **Governance** – These are key findings and observations related to the span of control exercised by the City and County, how decision-making authority is assigned under the existing legal frameworks, how the jurisdictions communicate, collaborate, coordinate and cooperate across functional and geographic boundaries, and how the utility is governed.

Operational Findings and Observations

Our reviews of core business processes related to system planning and management, meter to cash and field operations are captured in the Task 4, 5 and 6 reports. These reviews spanned 16 discrete operational areas and generated dozens of findings and observations. The most significant and consequential of these findings are summarized in the three exhibits below:

Exhibit E-1. System Planning and Management Findings

Program Element	Key Observations
Capital Programs	▪ Both jurisdictions manage capital project delivery "competently." ▪ Each jurisdiction scored a 3 (Competent) out of 5 on a capital program management self-assessment survey. (1 = Basic, 3=Competent, 5=World Class). ▪ A lack of an effective joint planning capability is constraining capital program efficiency. ▪ The Water Analyzer Office is understaffed. ▪ City and County are not using metrics to evaluate program performance.
Water Loss Management	▪ Water loss ranged from 16% to over 35% between 2010 and 2019. ▪ The City conducts regular water audits following industry-standard methods and practices. ▪ The program has no long-term water loss reduction plan. ▪ There is no clear delineation of City and County roles and responsibilities related to water loss management efforts.
Drought Response Planning	▪ No drought response plan has been developed. ▪ There is little understanding within each organization of roles and responsibilities during a drought. ▪ There is a decision-making framework for actions that should be taken before, during and after the declaration of a drought. ▪ There is a plan for coordinating drought management activities between jurisdictions.
Safety Programs and Risk Mitigation Planning	▪ Baltimore City has an effective safety program. ▪ Additional leadership/professional resources and organizational streamlining would aid program effectiveness. ▪ The program would benefit from implementing more transparent safety policies/procedures and providing training on best practices. ▪ The County's Safety Office is simultaneously accountable to three separate County departments. ▪ Neither jurisdiction was able to demonstrate that they use data to review overall safety trends or assess performance. ▪ There is little oversight and coordination on safety issues for workers operating across jurisdictional boundaries.
Source Water Protection and Land Use Management Planning	▪ The current framework for source water protection is consistent with industry standards and best practices, but it is ten years old and should be updated. ▪ The City and County need to improve coordination on management of the deer population and recreational use in reservoir areas.

Exhibit E-1. System Planning and Management Findings

Program Element	Key Observations
	▪ The County maintains a robust and multifaceted source water protection program integrated with its watershed protection and restoration strategy. ▪ Current land-use policies are in place that support source water protection goals.
Performance Management and Continuous Improvement	▪ City DPW maintains the semblance of a performance management program through its Office of Strategy and Performance. ▪ DPW's program is not linked to an up-to-date strategic plan. ▪ DPW's program does not maintain a robust set of performance measures or a structured reporting process. ▪ DPW's program does not regularly review performance to establish goals and targets. ▪ The County's framework for performance management and continuous improvement is outlined in the County's new strategic plan, but the plan only peripherally impacts water and sewer operations. ▪ Neither jurisdiction's water and sewer operations can be considered "performance-driven" since they cannot document that they maintain formal programs to track and monitor performance or actively support continuous improvement through programs or processes.
Inter-jurisdictional Communication	▪ The City and County have no formal communications procedures for any of the core functions included in this business process review. ▪ With few exceptions, most senior staff who were interviewed during the functional review part of this study indicated that they did not maintain any form of an ongoing relationship with their counterparts, did not have regular coordination meetings and did not have a clear understanding of when and how issues or concerns should be escalated. ▪ Communications on inter-jurisdictional issues primarily take place at the Director level. ▪ Except for meetings and discussions between the City and County about the annual water and sewer settlements, regular coordination meetings are not taking place at the Bureau or Division level. ▪ There are no standing inter-jurisdictional task forces, workgroups or committees that have been formed around any other functions.
Information Technology (IT) Systems Review and Disaster Recovery	▪ City IT staff verbally confirmed the existence of disaster recovery procedures for critical systems but did not provide written documentation of any plans or policies. ▪ Staff believes that the Legacy billing system is viable over the short term, but an eventual migration of all customers to the new UMAX billing system is expected. ▪ There is no clear dissemination of IT oversight and management responsibilities between CSSD, DPW's IT Office and Baltimore City's IT Department. ▪ There was a lack of planning and coordination between the City and County during the development and rollout of the UMAX system. ▪ The City and County's GIS systems are not integrated, so City maintenance staff do not have access to County utility GIS data. ▪ County Bureau of Utilities staff does not have access to the City's Cityworks work order system.
Sewer Capacity Planning	▪ There is consensus that the 1974 Sewer Agreement needs to be updated. ▪ There is no documentation of Baltimore County's allocation of capacity at the Back River WWTP. ▪ Re-establishing the Wastewater Analyzer Office would improve how the City and County communicate and coordinate on sewer capacity planning issues.

Exhibit E-2. Meter to Cash Findings

Program Element	Key Observations
Metering & Billing Operations	▪ The City is operating two different meter to cash processes at the same time. ▪ SOPs have been established for all facets of the customer metering and billing process, but adherence to SOPs is not documented. ▪ The 2019 ransomware attack and 2020 pandemic resulted in major interruptions to customer billing functions. ▪ There are large backlogs of work orders and unresolved repairs to water meters. ▪ The City lacks an effective QA/QC process to ensure that accurate bills are issued regularly. ▪ Billing adjustments and customer account changes are not being documented consistently and in a manner that adequately supports the County's sewer billing processes. ▪ There has been a dramatic increase in delinquent accounts since 2017.
County Revenue Collection & Annual Reconciliation	▪ Unresolved disputes date back to Fiscal Year 2014. ▪ There have been large, unexplained changes in billed revenue and allocated costs over the past six fiscal years. ▪ Deficiencies and issues identified in past audits and reviews have not been fixed. ▪ Little expertise and institutional knowledge remain in either organization regarding the legal and technical requirements of the annual water settlement process. ▪ There are known issues and problems with the current Cost Allocation Model. ▪ There is no structured QA/QC element in the financial settlement process.
City-County Data Transfer	▪ The County's sewer billing process is dependent on inputs from the City's outdated, unsupported legacy billing system. ▪ There is no continuity of operations plan to ensure the data transfer process can recover from unforeseen disruptions. ▪ The timing of data transfers and critical reviews is not aligned with the County's sewer billing schedule. ▪ The City's approach to water bill adjustments is inconsistent with the County's sewer bill dispute resolution process. ▪ There is no QA/QC process in place to ensure that accurate billing data is being transmitted. ▪ There are no performance standards in place for the data transfer process.
Customer Service Performance	▪ There is a significant backlog of unresolved County escalations. ▪ Water bill adjustments are being poorly documented. ▪ There are breakdowns in communication between CSSD and Metro Billing. ▪ There is no documentation that customer service-related SOPs are being followed. ▪ Past reviews and audit findings have not been addressed. ▪ Neither organization is measuring customer service performance or customer satisfaction.
County Sewer Billing & Meter Applications Permitting	▪ The current meter application process is reliant on the transmittal of paper applications and forms. ▪ The current process is overly complicated and is not being managed by a single entity. ▪ The meter installation process lacks a robust post-installation inspection and certification element. ▪ There are no documented SOPs.

Exhibit E-3. Field Operations Findings

Program Element	Key Observations
City/County Field Operations Coordination	▪ There are no quantitative or qualitative service level measures between the City and County on field operations. ▪ There are no target performance measures for work that is performed in the County by City maintenance forces. ▪ There is a duplicate investigation process in place but no coordinated information-sharing mechanism. ▪ Both the City and County's utility maintenance operations are overly reactive. ▪ There are no standard operating procedures to address coordination of restoration work, notification of work order status and customer communications. ▪ Work crews are unaware of ongoing work within an area by the other jurisdiction. ▪ City utility crews cannot access County utility data in GIS. ▪ City utility maintenance is not notified when County contractors are performing water utility work. ▪ City work order documentation is often deficient and cannot be relied on to support sewer billing adjustments.
Customer Complaint Resolution	▪ County customers have to call multiple phone numbers, depending on what problem they are trying to address. The number listed for water meter issues is the City Hall operator. ▪ The complaint resolution process does not emphasize resolving issues on the "first call," which is an industry best practice. ▪ Customer complaint resolution performance metrics are not being tracked. ▪ There are no performance targets for work performed by City crews in the County. ▪ County Bureau of Utilities personnel do not have access to the City's SalesForce customer complaint system or the Cityworks work order system, so they cannot investigate County customer's complaint status. ▪ Neither jurisdiction conducts surveys of customer satisfaction with service call response.

Organizational Findings and Observations

In our review of the City and County departments, bureaus, and divisions responsible for the operation and management of the regional water and sewer systems, we found that both jurisdictions have done a commendable job of effectively communicating objectives and priorities to their employees. City and County supervisors are generally satisfied with their jobs, and most believe that their job specifications are accurate. It was also apparent that the City and County have done a commendable job of maintaining critical services under the extraordinary challenges that both Departments of Public Works have had to face through the COVID-19 pandemic.

However, both organizations face several significant constraints that will impede their collective ability to operate the utility efficiently and effectively now and into the future. These constraints include:

- **Higher than average vacancy rates** – The vacancy rates for DPW employees (18% in the City and 12% in the County) are worse than industry averages and support the need for effective workforce succession planning.
- **High turnover rates in key positions –** The City has experienced a high turnover rate in several critical operational positions, including the Chief of the Customer Services & Support Division, the Chief of Engineering and Construction, Chief of Asset Management and Chief of Utility Services.
- **Changes in senior leadership –** Both the City and County are searching for a permanent Director of Public Works position. The lack of a permanent position has led to some critical decisions being postponed. Several senior managers in both organizations are in an acting capacity.

- **Lack of an effective succession planning effort –** There is a lack of succession planning, with several employees eligible to retire within the next five years. The knowledge capture process is lacking, with little documentation of standard operating procedures. An over-reliance on contractors and consultants for essential water and wastewater functions has diminished the knowledge maintained in-house.
- **Starting and top salaries for several positions are not competitive with surrounding utilities and private firms –** The salary survey data indicates that both City and County starting and top salaries for many technical classifications (such as utilities supervisors and engineers) are significantly below surrounding counties and other regional utilities, such as WSSC.

We challenged City and County managers to provide feedback on how they thought many of these organizational constraints could be addressed. Their responses to our survey questions provided many useful insights about improvements to current utility-related business processes in the City and County, including:

- Improved internal and external communication
- A clearer definition of roles and responsibilities
- Independence from politics
- Better technology and software
- A strong, long-term vision unaffected by transitions in administrations
- "Servant leadership" in which managers and leaders need to focus on serving their teams
- Modification as to how the HR, procurement and training support functions work with operations staff
- Increased staffing and opportunities for employees to grow in their careers
- Facilitated strategic planning sessions at the department level
- Adjustments to salaries to make them competitive with that of other utilities and private firms

We identified several opportunities to align the City and County's current organizational structures with a best practice utility organization. The most significant and far-reaching opportunities are summarized in the exhibit below.

Exhibit E-4. Opportunities to Strengthen the Existing Organizational Structure

Characteristic	Best Practice Alignment
Staffing	Staffing goals should be established and regularly tracked and reviewed by both operations and senior management. Data measured and reported should include vacancies, employee retention, job satisfaction, workforce succession preparedness, training hours, etc.
Succession Planning	A three to five year succession plan should be created for critical operations and management staff to prepare future leaders to seamlessly assume key leadership positions. The process should include internal and external education, training and the opportunity to learn in various areas of responsibility. The plan should be reviewed on a semi-annual basis and modified as necessary.
Knowledge Capture	A formal knowledge capture process should be implemented to capture the experience and expertise of employees retiring or otherwise leaving the organization. The process should be applied to water and wastewater operations, utility finance, billing, safety and other related functions. Knowledge captured should be incorporated into centrally managed standard operating procedures. Key retired staff should be interviewed to add their experience and expertise to the SOPs or procedures.
Salary Study	An independent study of salaries for key water and wastewater employees should be performed. The study should analyze data from utilities across the nation along with national databases. Action should be taken to establish competitive salaries, and the results of the study should be presented to employees.

Exhibit E-4. Opportunities to Strengthen the Existing Organizational Structure

Characteristic	Best Practice Alignment
Strategic Planning	Management should continue to ensure that employees at all levels of the organization understand their role in achieving its mission and strategic goals. Strategic plans should be kept up to date, and steps should be taken to achieve the goals outlined.
Communications	Top management should establish an open, collaborative culture and blend the organization into a single, cohesive team focused on common objectives. Team building activities should be commissioned for teams that must work together to ensure high performance. The top organizational executives should issue timely communications to employees on the current state of affairs, new initiatives and positively encourage the workforce to better serve their customers. Holding small group meetings and periodic worksite visits should also be utilized to connect with the employees who work diligently to serve citizens' best interests.

Governance Findings and Observations

Under the current governance framework, the City is responsible for the operation and maintenance of the water distribution system and related assets (pumps, storage, etc.) for both the City and the Metropolitan District, all water filtration facilities, the wastewater conveyance systems within the City and all wastewater treatment plants. The City is also responsible for billing and customer service for all water customers in the City and County. Water and wastewater rates, fees and charges for City customers are set by the City's Board of Estimates.

Baltimore County is responsible for the planning, design and construction of new water facilities that solely benefit County customers and the operation and maintenance of the County's wastewater conveyance system, including sewage pumping stations. The County is responsible for billing and customer service related to wastewater service for County residents. Water and wastewater rates, fees and charges for County customers are set by the County Executive.

These areas of functional responsibility are shown in the following exhibit.

Exhibit E-5. Current Water and Wastewater City/County Governance by Function

Service	Major Function	Responsibility
Water	Rate Setting	County establishes, City implements
	Customer Billing	County for its Water Distribution Charge, City for other rates
	Raw Water Supply & Treatment	City
	System Maintenance & Operation	City
	Development Approval	Handled independently by each jurisdiction
	Water Facility Master Planning	Handled jointly through Water Analyzer Office
	CIP - Planning & Implementation	County for projects serving County customers, City for others
Wastewater	Rate Setting	Set independently by each jurisdiction
	Customer Billing	Handled independently by each jurisdiction
	Wastewater Treatment	City
	System Maintenance & Operation	Handled independently by each jurisdiction
	Development Approval	Handled independently by each jurisdiction
	Wastewater Facility Master Planning	Handled independently by each jurisdiction
	CIP - Planning & Implementation	Handled independently by each jurisdiction

The City-centric governance framework established over 75 years ago gives the City's Director of Public Works exclusive authority to make decisions on almost every aspect of the water system, including billing and metering policies and procedures, budget and resource allocation, personnel hiring and terminations, organization structure, strategic priorities, management of the reservoirs and capital priorities.

Under the current governance framework, the City and the Director of Public Works are not accountable for County customer service delivery, system reliability or operational efficiency, even though Baltimore County has more than half of the system's customer accounts and is responsible for all demand growth.

As a result of the comprehensive review that examined all of the core business processes used by the City and County to operate and maintain the regional water and sewer systems, we have identified six significant shortcomings in the current governance structure:

1. The current governance framework has been ineffective in resolving long-standing disputes over customer billing issues and annual water reconciliation.
2. The current governance framework does not support a culture of continuous improvement and accountability regarding customer service delivery, system reliability and maintenance responsiveness.
3. The current structure does not support effective inter-jurisdictional communications across all levels of the two organizations. As a result, there is no evidence that true collaboration and cooperation occur between the City and County on essential matters such as strategic planning, long-range planning, capacity management, emergency response, regulatory compliance, service interruptions, service changes, safety issues or other emerging areas of concern.
4. The current governance structure does not support the high level of coordination needed to project, plan and execute system improvements to meet growing demand in Baltimore County and other jurisdictions. Although the current framework identifies a joint planning office to be staffed by City and County personnel for this purpose, there is no requirement for either jurisdiction to provide resources to ensure that this function is performed effectively and efficiently.
5. There is no oversight process defined in statute or agreement to ensure that the Director of Public Works' policies, procedures or decisions are in the best interest of both City and County customers. Many decisions made by the City's Director of Public Works have far-reaching implications for Baltimore County customers. These decisions often receive approval through the City Board of Estimates or oversight by the Baltimore City Council, but there is no mechanism for review by County elected officials.
6. The current governance structure has no requirement or mechanism to conduct strategic planning across jurisdictional boundaries. This means that planning functions within the utility are not aligned with the City or County's strategic goals and priorities.

The Path to World Class

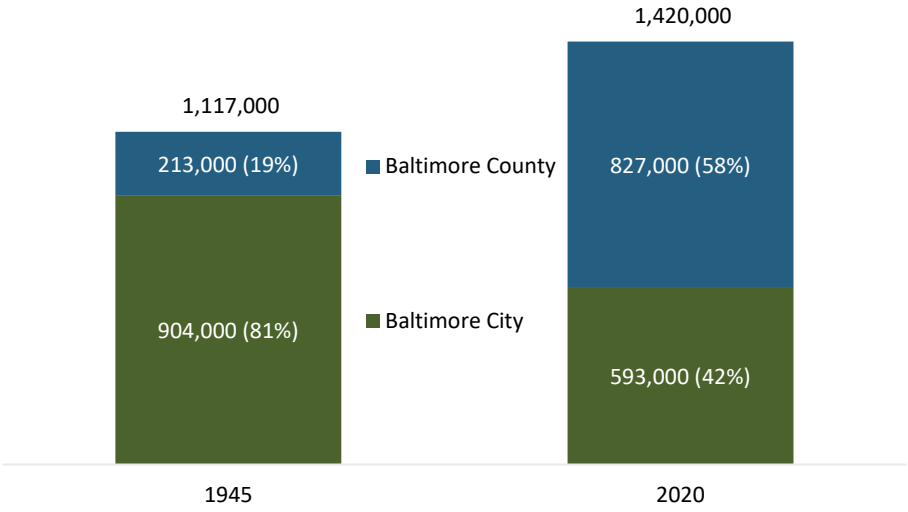
We have identified numerous opportunities to improve many of the City and County's core business processes to operate and manage the regional water and sewer systems. Each of the six task section details findings and observations that characterize the gap between the current City-County approach and a best-practice approach that might be used by a "world-class" utility.

While many of the issues and deficiencies that we have outlined in this report could be addressed by improving how the two jurisdictions cooperate, collaborate, coordinate and communicate, there are several structural shortcomings with the current form of utility governance that cannot be easily changed.

As the City and County's leadership consider how to best achieve their shared vision of a "Utility of the Future, some consideration of alternative governance structures may be necessary.

The current governance structure was adopted when Baltimore City was the State's primary center of industry and commerce and the most populous jurisdiction in Maryland. When the Acts of 1945 were adopted, Baltimore County had less than a quarter of the City's population and was largely undeveloped. No one could have anticipated the demographic shifts that would occur over the following 75 years. A new evaluation of City and County roles and responsibilities in the utility is long overdue.

Exhibit E-6. Change in City and County Population



To assist the Leadership Team in its consideration of potential next steps and options, we have developed detailed case studies for five utilities that have evolved from similar discussions about the need for a change in governance. These examples are summarized in the exhibit below.

Exhibit E-7. Governance Model Examples

Example	Organization Type	Governance Structure
Cape Fear Public Utility Authority, NC	Water and wastewater authority	▪ Board of Directors consisting of five members appointed by each the City of Wilmington and New Hanover County. ▪ Ten members nominate an eleventh member acceptable to both the City and County and confirmed by both governments. ▪ The directors serve three-year staggered terms without compensation. ▪ The Board elects a Chairman, a Vice-Chairman, a Treasurer and a Secretary from the ranks of Board members. ▪ The Board has the authority to set rates and fees without approval by either the City or County. ▪ The Authority has no taxing ability and must depend solely on rates and fees for its revenues. ▪ The Authority can issue revenue bonds that are not backed by the City or County.

Exhibit E-7. Governance Model Examples

Example	Organization Type	Governance Structure
Washington Suburban Sanitary Commission	Water and sewer commission established by State law	▪ Montgomery County and Prince George's County each appoint three commissioners to serve three-year terms as a commissioner. ▪ The Commissioners nominate a chair and vice-chair to serve a one-year term. ▪ The Commissioners hire a General Manager/Chief Executive Officer. ▪ The Commission recommends rates and charges, which must be approved by each County through the budget approval process.
DC Water	Water and sewer authority with a significant number of diverse wholesale and retail customers	▪ DC Water is governed by a Board of Directors consisting of 11 principal members and 11 alternate members. Six Board members are District residents, appointed by the Mayor with the advice and consent of the Council. No more than four may be District employees or officials. One shall be the Director of the District Department of the Environment or a cabinet-level officer, as determined by the Mayor. ▪ The Mayor appoints persons recommended by the other participating jurisdictions to the remaining five Board positions. Of the five non-District Board members appointed by the Mayor, one Board member shall be recommended by Fairfax County, two shall be recommended by Montgomery County, and two shall be recommended by Prince George's County. ▪ All board members participate in the decisions directly affecting the management of the joint-use facilities. The District of Columbia members participate in those matters that affect District ratepayers and in setting fees for various services. ▪ DC Water may only take action on policy matters after receiving a favorable vote of no less than six members of the Board of Directors.
City of Richmond and Henrico County, VA	Wholesale and retail customer relationship which evolved into the retail customer becoming an independent water supplier	▪ Utilities are operated and managed as municipal departments. ▪ Operating and financial relationship is governed by terms of the wholesale purchase agreement.
Rivanna Water & Sewer Authority, VA	Regional water and sewer authority	▪ Seven member Board of Directors consisting of Albemarle County Executive, Albemarle County Supervisor, City of Charlottesville City Manager, City of Charlottesville City Councilor, City of Charlottesville Director of Utilities, Albemarle County Service Authority Executive Director, Appointee of City and County.

In our experience, there are many benefits that Baltimore City and Baltimore County could realize by consolidating management of the water and sewer system into a single entity. These benefits include:

- Improved supply reliability through risk pooling
- Lowered unit cost through economies of scale

- Sustained access to low-cost financing
- Standardized high-quality water
- Reduced negative social and environmental impacts
- Regional investment in conservation and local supplies
- Enhances technical expertise for problem-solving
- Amplifies voice in policy matters

The consolidation process can be complex and challenging, and any significant change in the business relationship between the City and County will ultimately require legislative changes and negotiation of new inter-jurisdictional agreements. In advance of any significant decisions about the structure of the regional water and sewer system, several preliminary steps should be taken to support future discussions about regionalization. These include:

- Updates to water and sewer asset inventories in the City and County
- Developing an updated valuation of assets in each jurisdiction
- Convening a stakeholder advisory group to explore pros/cons of regional options with a broad range of stakeholders
- Estimating unfunded regulatory costs for the water and sewer systems
- A detailed assessment of the current financial position of each utility, including an evaluation of unfunded pensions and post-employment benefits
- An assessment and analysis of outstanding water and sewer bills

Closing Statement

The Baltimore metropolitan region has been blessed with an abundant supply of fresh water, which supports life, commerce and industry. With the water supply comes a requirement for stewardship. Based on the findings and conclusions of this study, it appears that stakeholder groups are not satisfied with the current status and performance of the water and sewer systems serving the City and County. There is a range of regional coordination and integration options that could be pursued, ranging from simply revising existing law and agreements to creating a regional management agency that contracts with the County and City to perform certain functions to an independent regional agency without taxing powers that would be dependent solely on rates and fees for income, and which would be limited in the range of services it could provide. Based on the extensive data collected during this study, the range of alternatives should be examined by a stakeholder group representing a wide range of perspectives and interests. The group could recommend to elected officials the "best" coordination and integration model for regional water and wastewater services.

Task 1
EVALUATE CITY-COUNTY EXISTING SERVICE AGREEMENTS FOR WATER/SEWER SERVICES

Scope

The project team was requested to provide a high-level review of the 1972 Inter-governmental Water, 1974 Inter-governmental Sewer service agreements and a few other agreements that currently are in effect, in the context of facilitating the ongoing collaboration between the Leadership Team. These agreements are the basis for the coordinated delivery of water and sewer services to the County and City's customers. Specifically, the project team was requested to perform the following scope of services for this task:

- Review service agreements including the 1972 Inter-governmental Water and 1974 Inter-governmental Sewer agreements, and a number of additional agreements, to understand the context.
- Summarize the existing service delivery frameworks including the structure and key terms of the agreements, cost allocation methodology, key parameters included and assumptions defined in the agreements.
- Use visualizations and other techniques, as appropriate, when summarizing agreement terms and protocols to enable ease of understanding.
- Provide observations on strengths, constraints, risks and challenges pertinent to the agreement terms in the context of similar agreements.
- Identify and determine the alignment between the agreement terms and stipulations as well as its practical implementation.

Methodology

This is an evaluation of the relevant laws, agreements and court decisions that have governed or currently govern the inter-jurisdictional water and sewer relationship between Baltimore City (the "City") and Baltimore County (the "County"). Some laws which were once in effect have since been repealed but are included to understand the history of where we are today. The laws, agreements and court decisions below are in chronological order. In the preparation of this evaluation, in addition to the review and analysis of each of the documents described herein, interviews were also conducted with various representatives of the City and County. A major point of focus was placed on (i) agreements between the City and County dealing with water rates to be charged by the City to consumers in the County; (ii) the cost to the City of furnishing water to the consumers in the Metropolitan District of the County and (iii) how the City is to be reimbursed by the County for those costs. A part of that major focus was an evaluation of the laws governing those points identified in (i)-(iii) above. The evaluation has identified several legal and contractual issues emanating from said review and which are discussed below for consideration by the City and County.

Background

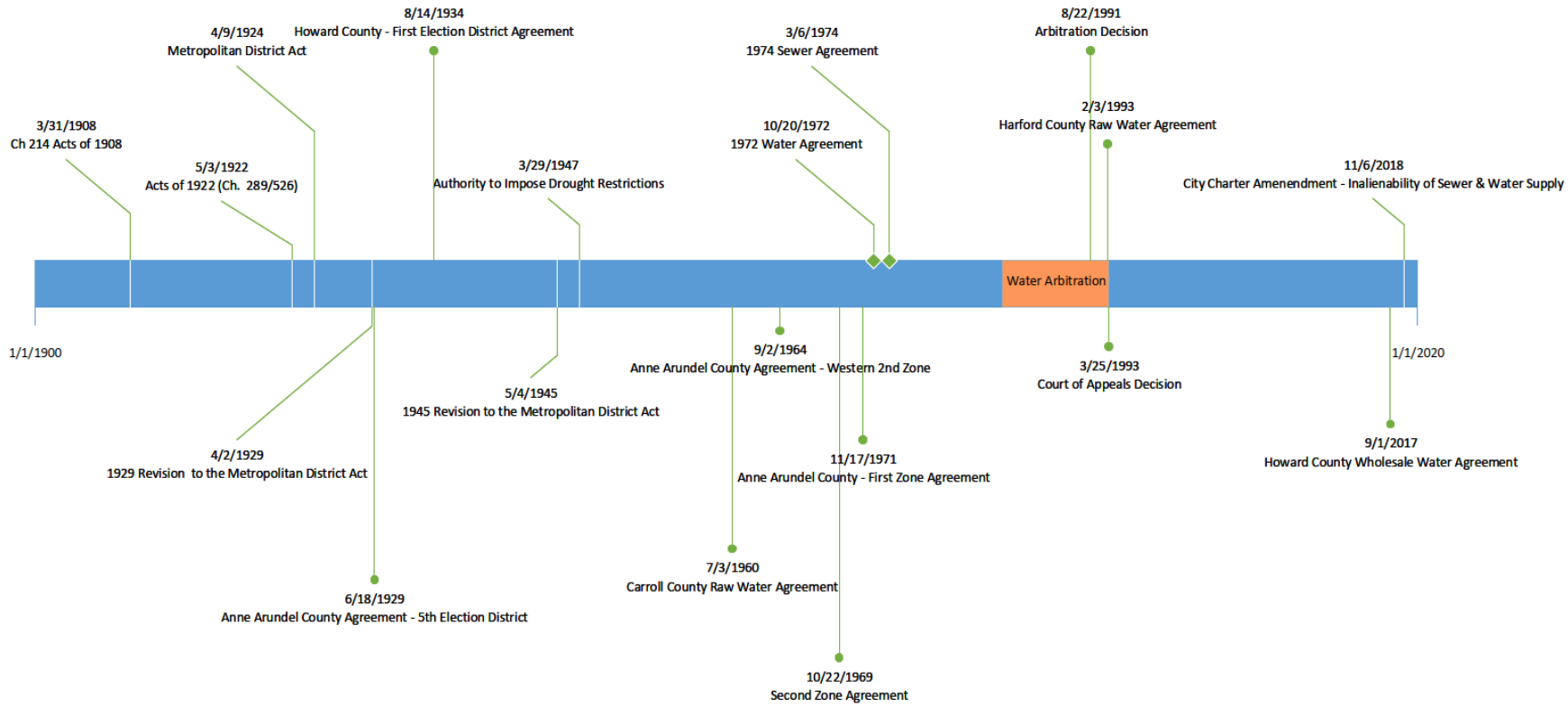
History of the City-County Water System

Baltimore City owns and operates facilities that provide drinking water to over 1.4 million residents in the Baltimore metropolitan area. The service area includes all of Baltimore City, most of the densely populated

areas of Baltimore County and parts of Anne Arundel and Howard Counties. This system includes raw water reservoirs, transmission facilities, treatment facilities, pumping stations, storage tanks, hydrants, valves and water meters and over 3,100 miles of distribution mains in the City and Baltimore County. The City bills City and County residents directly for water service and provides water to Anne Arundel and Howard Counties on a wholesale basis. Baltimore City also sells limited amounts of raw water to Carroll and Harford Counties.

The legislative history of the Baltimore Metropolitan Water System, shown in the exhibit below, dates back to the turn of the last century when the City was granted unlimited authority over the Gunpowder and Patapsco Rivers for its water supply. The development of the municipal system was extended into Baltimore County in 1924 with the enactment of the Metropolitan District Act.

Exhibit 1-1. Legislative History of the Baltimore Water System



The Metropolitan District Act

Chapter 539 of the Laws of the State of Maryland of 1924 ("Acts of 1924"), which was codified in the Code of the Public Local Laws of Maryland (1930), Article 3, §§ 327-346, created a Metropolitan District in Baltimore County to provide for the construction, maintenance, operation, purchase or condemnation of water supply, sewerage and stormwater drainage systems. The act authorized the Baltimore County Commissioners to issue bonds for construction of water infrastructure, levy taxes and establish water and sewer charges to pay for the bonds. Notably, the Metropolitan District Act established Baltimore City as the billing authority for Baltimore County customers and the Maryland Public Service Commission (PSC) with a role in rate setting. The role of the PSC in rate setting is discussed later in this section.

After the Acts of 1924, twenty years later, the General Assembly passed the Acts of 1945 to clarify the obligation of Baltimore City to Baltimore County. In doing so, the Acts of 1945 repealed the Acts of 1922 and amended and clarified the Acts of 1924, particularly concerning water service rates. The Acts of 1945 are still in effect to this day, and the Baltimore County Code has adopted the Acts of 1945, see, for example, Article 20 of the Baltimore County Code, Sections 20-1-115 and 116.

The following provisions in the Acts of 1945 have particular relevance to the finances and governance of the Baltimore Water System concerning Baltimore County.

Section 332 (a)

- "The operating control of water extensions in the Metropolitan District shall be in the hands of the Mayor and City Council of Baltimore who shall bill and collect the water rates established as hereinafter provided, and shall maintain the water distribution system in as good a condition, and the water service in as efficient a manner as the remainder of the water system owned and operated by the City of Baltimore so that there shall be at all times an adequate flow of water fit for human consumption, none the less pure than the water furnished by the Mayor and City Council of Baltimore to the inhabitants of Baltimore City, and sufficient to supply to the inhabitants of Baltimore County, water for all public, private, domestic, manufacturing or other needs which the water mains were designed or intended to supply."

Section 332(b)

- "The rates to be charged by Baltimore City for furnishing water to consumers in Baltimore County shall be established by agreement between the City of Baltimore and the Commissioners, subject to approval by the Public Service Commission of Maryland. In the case of disagreement as to the rates to be fixed, the Public Service Commission of Maryland shall, upon the application of the Commissioners, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the Courts by either party, as is provided by law in the case of rates for Public Service Corporations fixed by the Public Service Commission. The rates, however, established, shall be subject to revision from time to time by agreement of the City of Baltimore and the Commissioners, subject to the approval of the Public Service Commission."

Section 332(c)

- "The Mayor and City Council of Baltimore shall furnish water to the Metropolitan District of Baltimore County at cost and entirely without profit or loss. The Commissioners and the Mayor and City Council of Baltimore shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the Metropolitan District of Baltimore County. If no agreement is reached, then cost shall be determined by arbitration in the manner herein provided in Section 329.

Cost, however, determined, shall be subject to revision from time to time by agreement of the respective authorities, or by arbitration on the demand of either of them."

SECTION 332(D)

- "[Baltimore City] shall maintain proper records to adequately and correctly reflect the amount of all income received from furnishing water service to consumers in Baltimore County; and annually shall render a statement to [Baltimore County] showing the total revenues received from Baltimore County water consumers . . . and the actual cost of furnishing such water[.] The excess of the income over actual cost shall be transmitted by [Baltimore City] with the statement to [Baltimore County.]" Likewise, if the costs are greater than the revenues, then "the deficit shall be deductible from future payments accruing to [Baltimore County.]"

Although the Acts of 1945 established clear obligations on Baltimore City to provide water to Baltimore County residents at cost, the statute was silent over the method for calculating that cost. Between 1945 and 1972, the City and County agreed informally on the method for determining the "cost" to the City of furnishing water to County residents and how the City and County were to share costs. In 1972, the parties came to an agreement on the method of determining the City's costs of supplying water to consumers in the Metropolitan District. The September 20, 1972 Agreement between Baltimore City and Baltimore County ("1972 Water Agreement") forms the basis of the City and County's current operating, financial and management relationship as it relates to the regional water supply system.

A complete summary and analysis of State laws that have influenced the Baltimore Water System are provided in Appendix A of this memorandum. Relevant local laws are summarized in Appendix C of this report.

1972 WATER AGREEMENT

The stated purpose of the 1972 Agreement was to continue the operation of the Baltimore Water System and to establish a method of computation and payment of expenses incurred by Baltimore City and Baltimore County in connection with said water system. Although the 1972 Agreement was primarily intended to formalize the City and County's established approach to determining annual costs, the agreement also addressed key planning, governance and operational roles and responsibilities.

KEY PROVISIONS OF THE 1972 AGREEMENT

Article III Responsibilities for New Facilities – Under the 1972 Agreement, each party is responsible for planning, designing and constructing Filtered Water Facilities located within its boundaries, except as authorized by Acts of the General Assembly. The planning, designing and constructing of all raw water facilities, raw water pipelines and treatment facilities is the responsibility of the City.

Article IV Joint Planning – Established a commitment to maintain a joint planning office – now known as the Water Analyzer Office - that would make detailed hydraulic, economic and statistical studies of the entire Baltimore Water System. The purpose of this office was to provide data on which to base plans for future increases in the capacity of existing facilities and construction of new facilities.

Article V Construction of Filtered Water Pipelines – Established that local codes, regulations and rules would apply to water pipelines constructed within each respective jurisdiction.

Article VII Operation and Maintenance of the Baltimore Water System – Established Baltimore County's obligation to pay, on an annual fiscal year basis, its proportionate share of all expenses resulting from the operation, maintenance and administration of the Baltimore Water System.

Article VIII Metered Water Billing and Customer Service Charges – Established how costs associated with customer billing, collections and customer service functions would be allocated to Baltimore County.

Article IX Debt Service – Established how debt service costs would be allocated among the parties.

Article X Major Repairs and Rehabilitations to Filtered Water Pipelines, 12 inches and larger in Diameter – Assigned major pipeline repair and rehabilitation costs based on original capital cost allocations. If this was not the method originally used, then these costs are to be apportioned by the flow distribution method for the current design period.

Article XI Future Facilities – Identified responsibility for planning, design and construction of new water facilities with corresponding locality where the facility will be constructed. Required notification and consultation of other parties who would benefit from the facility. Allocated capital expenditures are as follows:

- Filtered water pipelines - flow distribution method.
- Filtered water pumping station in storage facilities – incremental volume method.

Article XII Annual Recalculation of Costs – Requires the City to submit the Annual Water Cost Reconciliation Statement to the County by December 31st of each year and the transmittal of settlement funds within 60 days of receipt of the statement. The 1972 Agreement created a problem in the determination of the annual recalculation of the City's costs and the amount of money the City or County may owe to each other under the calculation formula set forth in the 1972 Agreement. The problem is that the Acts of 1945 require that the calculation be based on "total revenues" received by the City from County water consumers, while the 1972 Agreement requires that the calculation be based on "billed revenues" from County consumers. By not following the Acts of 1945 and the County Code, the City is required by the 1972 Agreement to provide the County with credit for all "amounts billed," regardless of whether the amounts are actually collected by the City. The representatives of the City and County who were interviewed were unaware of the basis on which the parties adopted this provision in the 1972 Agreement.

Article XIV Arbitration – Established arbitration process for resolution of disputes as follows:

> *In the event of any disagreement between the Parties over the terms of the 1972 Agreement, the Parties, shall submit, on the demand of either, the matter to arbitration. Each Party appoints one arbitrator. The two arbitrators are supposed to select a third arbitrator, who acts as chairman of the board of arbitration. If the two arbitrators cannot agree upon the third arbitrator, then the Chief Judge of the Court of Appeals shall designate the third arbitrator. The decision of the majority of the board of arbitrators is final and binding upon the Parties. (Art. XIV)*

Article XV Term of Agreement – The 1972 Agreement is intended to stay in effect until a new agreement is made between the Parties. If one Party wants to amend the 1972 Agreement and the other Party disagrees, either Party may initiate arbitration proceedings.

1972 Agreement Cost Allocation Framework

The 1972 Water Agreement established a methodology for determining how operational costs would be apportioned between the City and County. The methodology is necessarily complex because it defines how the cost of service would be calculated for every element of the utility, including system-wide functions as well as distribution-specific costs, such as pumping stations.

The 1972 Agreement defined several key cost allocation principles that form the foundation of the current Cost Allocation Model that is used to calculate the annual water settlement. These principles are defined in Article I of the agreement:

- **Flow Distribution Method** – Requires a hydraulic analysis, usually done on an analog and/or digital computer, of the water system or portion of the water system based on the design requirements used to select any improvement. Ratios of cost responsibility shall be developed by dividing the rate of water to be supplied to each political subdivision by said improvement under the design requirements used to select the improvement by the total rate of water to be supplied to all of the political subdivision by said improvement under the design requirements used to select the improvement.
- **Incremental Volume Method** – Requires a tabulation of the estimated increase in peak daily filtered water usage projected for each political subdivision from the time the improvement is to be placed in service until the end of the design period. Ratios of cost responsibility shall be developed by dividing the increase in peak daily filtered water usage projected for each political subdivision by the total increase in peak daily filtered water usage for all of the political subdivisions.
- **System Volumetric Method** – Requires a tabulation of the actual quantity of filtered water, including zonal unaccounted water, supplied to each political subdivision in all of the zonal distribution system. Ratios cost responsibility shall be developed by dividing the actual quantity of filtered water, including zonal unaccounted water, supplied to each political subdivision by the total quantity of filtered water, supplied to all the political subdivisions.
- **Zonal Volumetric Method** – Requires a tabulation of the quantity of filtered water, including unaccounted water, actually supplied each political subdivision in the zonal distribution system or systems served by said pipelines, pumping stations and/or storage facilities. Ratios of cost responsibility shall be developed by dividing the quantity of filtered water, including unaccounted water, actually supplied to each political subdivision by the total quantity of filtered water, including unaccounted water, actually supply to all the political subdivisions served by said pipelines, pumping stations and/or storage facilities.

The 1972 Water Agreement specifies that all expenses involved with the operation, maintenance and administration of the following facilities and/or functions shall be proportioned by the System Volumetric Method. This includes expenses associated with the collection, transmission and treatment of raw water, the management and administration of the system, Engineering Services in the Division of Water Supply not charged to specific projects, the operation and maintenance of pipelines 12 inches and larger in the Zonal Distribution Systems within Baltimore City and storerooms and yards utilized in the operation and maintenance of Filtered Water Facilities.

The 1972 Agreement further specifies that expenses associated with the operation, maintenance and administration of the chlorinator stations operating in conjunction with filtered water pumping stations, reservoirs and tanks in the Baltimore Water System, filtered water pumping stations and the filtered water reservoirs and tanks are allocated using the Zonal Volumetric Method.

Expenses related to engineering services and field inspection services provided by the City on County projects, the installation and repair of water meters, the investigation of complaints within Baltimore County, services provided by the City Water Consumer Services Division to Baltimore County residents and operation and maintenance of the Zonal Distribution Systems within Baltimore County are fully allocated to Baltimore County under the 1972 Agreement.

At the time that the 1972 Agreement was written, there were certain billing, data processing, customer service and collections functions that were provided by the units within the City government that were not solely supported by the Baltimore Water System. For these expenses, certain formulas were derived to estimate the County's proportional share of those costs. These expense categories include:

- 40% of the Bureau of Collections expenses were allocated to the water system.
- 100% of the direct and indirect expenses incurred by the Metered Water Section of the Bureau of Data Processing are allocated to the water system.

- Baltimore County's allocation of these costs is based on the percentage of water bills issued to County customers.
- Baltimore County's share of the City's customer service handling expenses is based on the percentage of complaints attributed to County customers.

In addition to the allocation of direct expenses for various functions that are performed by the City to provide water to County residents, the 1972 Agreement provided for an additional 6% to be added, ostensibly to cover indirect costs not specifically identified in the Agreement. A breakdown of the specific cost elements that are identified in the 1972 Water Agreement is provided below.

Exhibit 1-2. 1972 Water Agreement Cost Elements

Cost Component	Cost Basis	Agreement Reference
The collection, transmission and treatment of raw water.	System Volumetric	Article VII.A
The General Supervision of the Administration Section of the Division of Water Supply of Baltimore City except those charges excluded under Article IV of the agreement (joint planning).	System Volumetric	Article VII.A
The Engineering Services in the Division of Water Supply not charged to specific projects.	System Volumetric	Article VII.A
The operation and maintenance of all pipelines in the zonal distribution systems within Baltimore city until June 30, 1972. Effective July 1, 1972, and continuing thereafter, this item shall include only the operation and maintenance of pipelines 12 inches and larger in the zonal distribution systems within Baltimore city.	System Volumetric	Article VII.A
The storerooms in yards are utilized in the operation and maintenance of filtered water facilities.	System Volumetric	Article VII.A
The chlorinator stations operation in conjunction with filtered water pumping stations, reservoirs and tanks in the Baltimore water system.	Zonal Volumetric	Article VII.B
The filtered water pumping stations supplying the Baltimore water system.	Zonal Volumetric	Article VII.B
The filtered water reservoirs and tanks supplying the Baltimore water system.	Zonal Volumetric	Article VII.B
The engineering in services rendered by the City on County projects.	Actual Expenses	Article VII.B
The field inspection rendered by the City on County projects.	Actual Expenses	Article VII.B
The installation and repair of water meters and the investigation of complaints within Baltimore County.	Actual Expenses	Article VII.B
The services rendered by the City Water Consumer Service Division for Baltimore County, including postage.	Actual Expenses	Article VII.B
The operation and maintenance of the Zonal Distribution Systems within Baltimore County.	Actual Expenses	Article VII.B
Water bill processing charges by the City Bureau of Collections	Based on unit cost per bill times number of County water bills	Article VIII.A.1
Water Bill processing charges by the City Bureau of Data Processing	Based on unit cost per bill times number of County water bills	Article VIII.A.2
Customer Complaint Processing	Based on the ratio of County water accounts to total water accounts in the system	Article VIII.B

Exhibit 1-2. 1972 Water Agreement Cost Elements

Cost Component	Cost Basis	Agreement Reference
Debt Service for repair or rehabilitation of Raw Water & Treatment Facilities	System Volumetric	Article IX
Debt Service for repair or rehabilitation of Filtered Water Pumping and Storage Facilities	Zonal Volumetric	Article IX
Debt Service for repair or rehabilitation of Filtered Water Pipelines 12" and larger	Flow Distribution Method	Article X
Capital Cost Allocation - Future Filtered Water Pipelines	Flow Distribution Method	Article XI
Capital Cost Allocation - Future Filtered Water Pumping Station or Storage Facilities	Incremental Volume Method	Article XI

It is important to note that the 1991 Arbitration decision had a significant impact on how costs were allocated within the 1972 Water Agreement framework. Although the City and County mutually agreed that costs would be allocated using a debt service approach, the City determined that it was dissatisfied with that approach because capital development within the water system began to shift significantly due to the high rates of growth and development that the County was experiencing.

This dispute, which lasted over a decade, was resolved when the arbitration panel issued a decision establishing that a utility basis of cost allocation for the Water System.

A detailed analysis of the 1991 Arbitration decision is provided in Appendix B.

1974 Sewer Agreement

The March 6, 1974 Agreement between Baltimore City and Baltimore County ("1974 Sewer Agreement") forms the basis of the City and County's current operating, financial and management relationship as it relates to the regional wastewater system. The Sewer Agreement was markedly shorter and simpler compared to the 1972 Water Agreement because the provisions of the agreement only had to address the interconnection of the two systems and the basis of calculating treatment, conveyance and pumping costs.

Chapter 539 of the Acts of 1924 created the Metropolitan District within Baltimore County and authorized the County to construct, maintain and operate sewerage systems within the Metropolitan District. Chapter 729 of the Acts of 1939 authorized the County to enter into contractual agreements with the City for the disposal of sewage or drainage and the establishment, construction, operation and enlargement of water supply, sewerage or drainage systems, and for the costs, rentals, service charges or other fees in connection therewith. The stated purpose of the 1974 Agreement was to continue the operation of jointly-used sewerage systems between the City and the Metropolitan District of the County and to establish a method for the computation and payment of costs incurred by the City and County in connection with said jointly-used sewerage systems.

Key Provisions of the 1974 Sewer Agreement

Article IV Limitation of Territory – This service agreement was limited to the service areas of the Back River Wastewater Treatment Plant and the Patapsco Wastewater Treatment Plant.

Article V Interconnection of Sewer Systems – The provision allowed either the City or the County to connect their wastewater collection systems together, subject to the approval of the other party. This provision, importantly, also established a framework for sewer capacity planning by specifying that each jurisdiction would develop and transmit flow projections and develop capital improvements to address future capacity needs. It was the responsibility of each Director of Public Works to ensure that adequate capacity existed within the interconnected system before approving new connections.

Article VI Stormwater, Surface Water and other Materials Not to be Discharged into Sanitary Sewers – This provision captured the City's long-standing prohibition against combined sewer and the conveyance of stormwater in the sanitary sewer system. This provision had later implications for the sanitary sewer Overflow consent decrees that were negotiated with the Maryland Department of the Environment and the Environmental Protection Agency because the 1974 Agreement was determined to provide both jurisdictions with sufficient authority to limit excess infiltration and inflow into the shared collection system.

Article IX Repairs and Rehabilitations – This provision established the Volumetric Method for allocating repair and system rehabilitation expenses.

Article X Financing of Additional Facilities - This provision established the Design Flow Method for allocating capital costs for jointly-used facilities.

Article XI Determination of Sewage Flow – This section of the agreement details how jurisdictional flows are to be calculated annually to allocate annual operating costs. The agreement specified that the annual wastewater contribution from one jurisdiction to the other would be based on the following:

- For areas that are not metered, use 100,000 gallons per year for every customer with a water service 1" or smaller and actual water consumption for every other customer, plus a 15% allowance for inflow and infiltration.
- For areas where the wastewater discharge is measured at a pumping station or permanent sewage metering stations, the annual flow contribution from the area upstream of the metering station will be the recorded flow, adjusted for any non-County customer contributions.

Article XII Determination of Sewerage Service Charges – This section of the agreement specifies that the annual sewerage service charges shall be computed by the Volumetric Method. The County shall pay to the City annually a Sewerage Service Charge representing the County's share of direct costs incurred by the City for transporting, pumping, treating and/or disposing of County sewage during the preceding fiscal year. The City shall pay to the County annually a Sewerage Service charge representing the City's share of direct costs incurred by the County for transporting and pumping of the City sewage through or by any County pumping station during the preceding fiscal year. The aforesaid direct costs shall include all of the operating and maintenance costs for jointly-used facilities, less any surcharges recovered for industrial waste. Also included are an applicable percentage of the operating management costs reported for the City's Waste Water Division, as well as other Bureau expenses properly chargeable to the City's Sewerage System, or their similar activities in the County as they may apply. The 1974 Agreement provides for the method of computation of (i) the County's share of operation and maintenance costs, (ii) the City's share of operation and maintenance costs, (iii) Operating Management Costs, (iv) applicable expenses of other Bureau Services, (v) computation of credit resulting from the sale of products and (VI) debt service. (Art. XII)

Article XVI Arbitration – The dispute resolution mechanism in the 1974 Sewer Agreement is binding arbitration. The provision states: "Disagreements between the Parties over the terms of the 1974 Agreement, including design, construction and financing of jointly-used facilities, shall on the demand of either, go to arbitration. Each Party selects an arbitrator, and the two selected are supposed to select a third arbitrator, who shall be the chair of the Board of Arbitrators. If the two arbitrators are unable to agree on a third arbitrator, the Chief Judge of the Court of Appeals of Maryland shall be requested to designate the third arbitrator. A written decision of a majority of the Board of Arbitrators shall be final and binding."

Article XVII Terms of Agreement – The 1974 Agreement remains in effect until the Parties amend it, or until a new agreement is made between them. If the Parties are unable to agree on an amendment, the 1974 Agreement shall continue in force.

Observations

1972 Water Agreement

Considering that the 1972 Water Agreement has remained in effect for 46 years is a testament to the care and effort that the City and County representatives put into crafting provisions that captured the spirit and intent of the Metropolitan District Act. There has only been a single dispute that required arbitration and subsequent litigation to resolve, and it is clear that neither the City nor the County believes that the decision to move from a debt service basis of cost allocation to a utility basis was not warranted.

The 1972 Water Agreement has been sufficiently robust to ensure the City's basic obligation to provide Baltimore County "at all times an adequate flow of water fit for human consumption, none the less pure than the water furnished by the Mayor and City Council of Baltimore to the inhabitants of Baltimore City" has been met. The system has expanded significantly over the last 46 years, primarily in Baltimore County, and facilities and infrastructure to meet the County's growth needs have been planned, designed and constructed as seamless enhancements to the regional water system.

During this time, the City and County have been able to meet many regulatory challenges and address problems of aging infrastructure with coordinated capital improvement plans. Under the current agreement framework, the City and County have been able to jointly plan and execute numerous facility improvements, including full plant modernizations at the Ashburton and Montebello Filtration Plants and total retrofits of the finished water reservoirs.

However, many aspects of the utility have changed over the past four and half decades, and many provisions in the current agreement are outdated or irrelevant. For instance, the 1974 Agreement has many references to organizational entities within Baltimore City that no longer exist or have been re-organized under a different structure. In addition, the City's recent efforts to modernize water meters and billing systems have exposed weaknesses in the agreement structure related to the annual reconciliation of costs. Finally, the ransomware attack on the City's financial systems and impacts from the current COVID-19 pandemic have highlighted the importance of communications, coordination and collaboration between the City and County to ensure that vital services are delivered without interruption.

We offer the following observations about the 1972 Water Agreement:

- The 1991 Arbitration decision resolved a long-standing dispute between the City and County and unambiguously established that a utility basis of cost allocation would be used in the annual financial reconciliation. After legal challenges to the ruling were resolved, it was assumed that the water agreement would be modified to reflect the changes that were directed by the arbitration panel. To

date, this has not occurred. Any new agreement should capture the key elements of the Arbitration decision.

- There are numerous organizational entities referred to in the 1974 Agreement that are no longer valid. These outdated entities include "The Division of Water Supply," "City Consumer Services Division," and "The Bureau of Data Processing." Any new agreement should generically define functions instead of organizational units to ensure that costs are captured consistently after reorganizations occur.
- Arbitration is the only approach to resolving disputes related to the operation and management of the regional water system. There is a long history of major and minor disputes between the City and County that have gone unresolved because of both jurisdiction's reluctance to seek arbitration. For instance, there have been ongoing disputes over billing data, billing adjustment, implementation of Advanced Metering Infrastructure (AMI) technology, implementation of a new billing system for County Customers and reconciliation of the Cost Allocation Model dating back to Fiscal Year (FY) 2014. A review of the correspondence history for many of these issues reveals some fundamental problems in the manner in which disputes are being resolved within the current agreement framework. Any new agreement should establish an alternative dispute resolution process, which could include mediation.
- Although the Metropolitan District Act specifies that the City must provide an adequate supply of water that has the same quality as water provided to City residents, there are no performance goals or service level commitments in any provisions related to how the City provides those services. Any new service agreement should consider minimum standards for customer service delivery and system reliability.
- As discussed above, the Metropolitan District Act provides a role for the Public Service Commission in the rate-setting process for Baltimore County customers. The County and City interpret that role to apply when there is a disagreement between them as to the rates to be set. Likewise, they agree that the Public Service Commission has no role with respect to rates to be set when there is no disagreement on the rates by the County and City. The Act is subject to various interpretations as to whether the Public Service Commission has a role in the rate-setting process for rates to be fixed when there is no disagreement as to those rates by the County and City. Any new agreement should address this requirement and clearly define how rates for Baltimore County customers will be established by Baltimore City in accordance with current laws.
- The City and County staff who developed the 1972 Water Agreement recognized the complexities involved with managing a regional water system, and they included a provision to create a joint planning office to analyze and develop data on which to base plans for future increases in the capacity of existing facilities and construction of new facilities. The Water Analyzer Office has been an integral part of management and coordination functions that were expected to take place under the 1974 Agreement, and many of the current cost allocation issues that have been documented in recent correspondence between the City and County can be traced back to a lack of commitment by both jurisdictions to fulfill the requirements of Article IV of the 1972 Agreement. Staff within both jurisdictions have expressed support for building up the capacity and capabilities of the Water Analyzer Office to bring quicker resolution to these issues.
- The 1972 Water Agreement provides for no coordination of maintenance and operations activities between the City Bureau of Water and Wastewater and the County's Bureau of Utilities. While there may have been little anticipated need for close coordination of routine and emergency water maintenance activities in the 1970s, the widespread impacts of water outages and water main breaks require a coordinated response and a robust communications process. The City and County should consider adding clear coordination and communication provisions for maintenance activity in the County in any future water agreement revisions.

1974 Sewer Agreement

The relationship between the City and County on wastewater services is significantly simpler because the City is primarily providing treatment capacity for Baltimore County. The 1974 Sewer Agreement defines the conditions for the interconnection of two systems and how costs will be shared, but there is little or no interaction between the City and County on the delivery of wastewater services to customers because each jurisdiction exclusively owns and operates the wastewater collection system within their borders.

We found no evidence of long-standing issues or concerns about the structure or implementation of the 1974 Sewer Agreement, nor are we aware of any significant financial disputes – such as the 1991 Water Arbitration- that have come up since the agreement was executed 44 years ago.

During our review of the business processes related to the regional wastewater system, however, we have noted several areas where coordination on wastewater issues could be improved. Accordingly, we offer the following observations about the 1974 Sewer Agreement:

- Unlike the 1972 Water Agreement, the 1974 Sewer Agreement did not establish a joint planning office to coordinate capital planning efforts related to the wastewater system. Given the fact that the City's two regional wastewater treatment plants provide capacity to three other independent jurisdictions, formalizing the establishment of a Wastewater Analyzer Office (which is an entity that existed until the mid-1990s) through the inter-jurisdictional agreement would ensure that essential planning coordination takes place.
- Unlike many wastewater service agreements, the 1974 Sewer Agreement is silent on issues related to capacity management within the collection system and treatment plants. Although the 1974 Agreement established a baseline for the County's share of existing debt service, the document does not identify a process for allocating capacities at the treatment plants. Historically, the City and County have relied on written correspondence to capture capacity assumptions that were used to establish capital cost allocations, but there is no formal process within the agreement framework that identifies how capacity is to be allocated or reallocated between jurisdictions. Capturing capacity management within a new agreement framework will ensure that future disputes can be addressed in a straightforward manner.
- The 1974 Sewer Agreement also provides for no coordination of sewer maintenance or pumping station operations activities between the City Bureau of Water and Wastewater and the County's Bureau of Utilities. While the need for coordination may only happen infrequently, each jurisdiction's response to large overflow events and widespread backups during rainstorms may necessitate the need for close coordination between the City and County utilities staff, so defining operational level coordination provisions should be considered in any future sewer agreement revisions.

Task 2
REVIEW THE CITY AND COUNTY ORGANIZATIONAL STRUCTURE AND GOVERNANCE MODELS

Task 2 consists of three subtasks related to the organizational structure of the water and sewer systems of the City and County as well as water and sewer governance models:

1. Review City Organizational Structure and Coordinated City-County Governance Model
2. Review County Organizational Structure and Governance Model
3. Governance Model Examples and Case Reviews

Scope

The project team was requested to perform a review of the existing organizational structure within the City and County and the coordinated City-County governance model, specifically with reference to the delivery of water and sewer utility services to the City and County customers. The project team was also asked, where feasible, to provide a summary and findings for each of the major functions associated with the City and County's delivery of water and sewer utility services. Specifically, the project team was requested to perform the following scope of services for this task:

- Review and summarize the existing organizational structure, within the City and County, specific to the provision of water and sewer utility services.
- Summarize the City and County's existing governance processes and protocols for aspects including planning, decision-making, approvals, performance management and hiring processes.
- Provide objective observations on strengths, constraints, efficiency and opportunities with respect to the City and County's existing governance model, and more specifically with respect to City-County inter-governmental coordination.

The project team was also requested to research and provide examples of effective governance models, in the context of multi-government coordinated utility service delivery, along with a case review for each governance model identified, and their decision-making process.

Given the coordinated governance between the City and County, this report is laid out as follows to complete the scope of services in a logical manner:

1. City Organizational Structure
2. County Organizational Structure
3. Coordinated City-County Governance Model
4. Governance Model Examples and Case Reviews

Methodology

A comprehensive request for information and data was provided to each Baltimore City and Baltimore County as the first step in our analysis. The data was analyzed and used as a basis for follow-up discussions and supplemental data requests.

On-site interviews were planned with key staff, but due to COVID-19, interviews were replaced by telephone interviews with key City and County water and sewer operations staff and other knowledgeable

individuals. The project team found that the City and County staff members that were interviewed were sincerely interested in achieving the study objectives and were very cooperative.

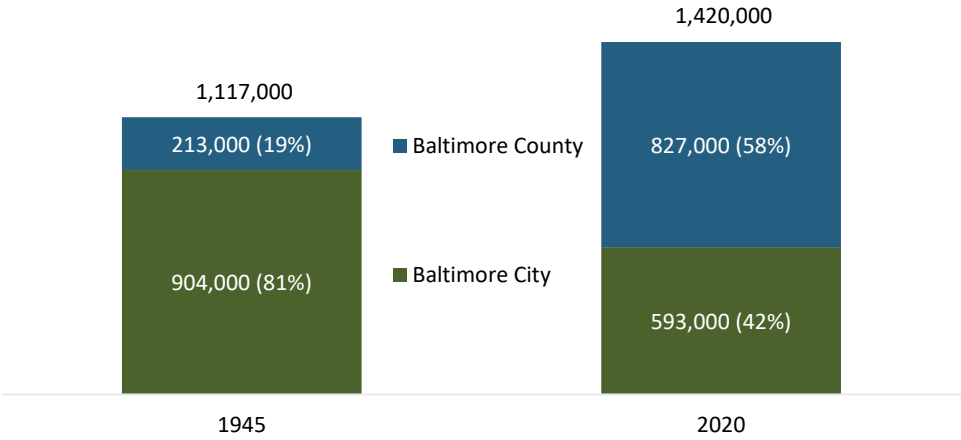
The project team invested time to understand the evolution of the water and sewer organization. The data provided by the City and County and the interview results allowed the project team to develop a thorough understanding of the Baltimore City and Baltimore County water and sewer organization and to provide findings and suggested best practices.

Background

As discussed in Task 1 of this report, dating back to the 1920s, legislation has been on the books in Maryland providing for the City's obligation to furnish water in Baltimore County, and in particular in the Metropolitan District. The previous legislation culminated in the Acts of 1945, which defined, in broad terms, the structure of governance for the utility.

When the Metropolitan District Act was re-enacted in 1945, the adopted governance framework was consistent with the City's preeminent role in the region. In 1945, Baltimore City was the State's primary center of industry and commerce and the most populous jurisdiction in Maryland, with almost 1,000,000 residents. As the chart below shows, the distribution of people in Baltimore City and Baltimore County in 1945 was vastly different from today. When the Acts of 1945 were adopted, Baltimore County had less than a quarter of the City's population and was largely undeveloped. As shown in the exhibit below, the City made up 81% of the Baltimore metropolitan region population in 1945, but now only makes up 42%.

Exhibit 2-1. Change in City and County Population



Because of this population split, the Maryland Legislature left the water utility's overall governance in the City's hands but enacted provisions to ensure that the City would fulfill Baltimore County's water supply needs at cost. The Acts of 1945 provide little guidance about Baltimore County's role in the utility's operation and management. The General Assembly did not anticipate the demographic shifts that would occur over the following 75 years.

The 1972 and 1974 Agreements provided some limited standards for organizational structures and obligations. The City and County recognized the importance of cooperation and collaboration in the system planning effort and incorporated provisions in the 1972 Water Agreement to create a jointly-staffed planning unit and assign roles and responsibilities for the design and construction of new facilities. But the inter-jurisdictional agreements were also mostly silent on how operational decision-making, communications, and coordination would occur on a day-to-day basis.

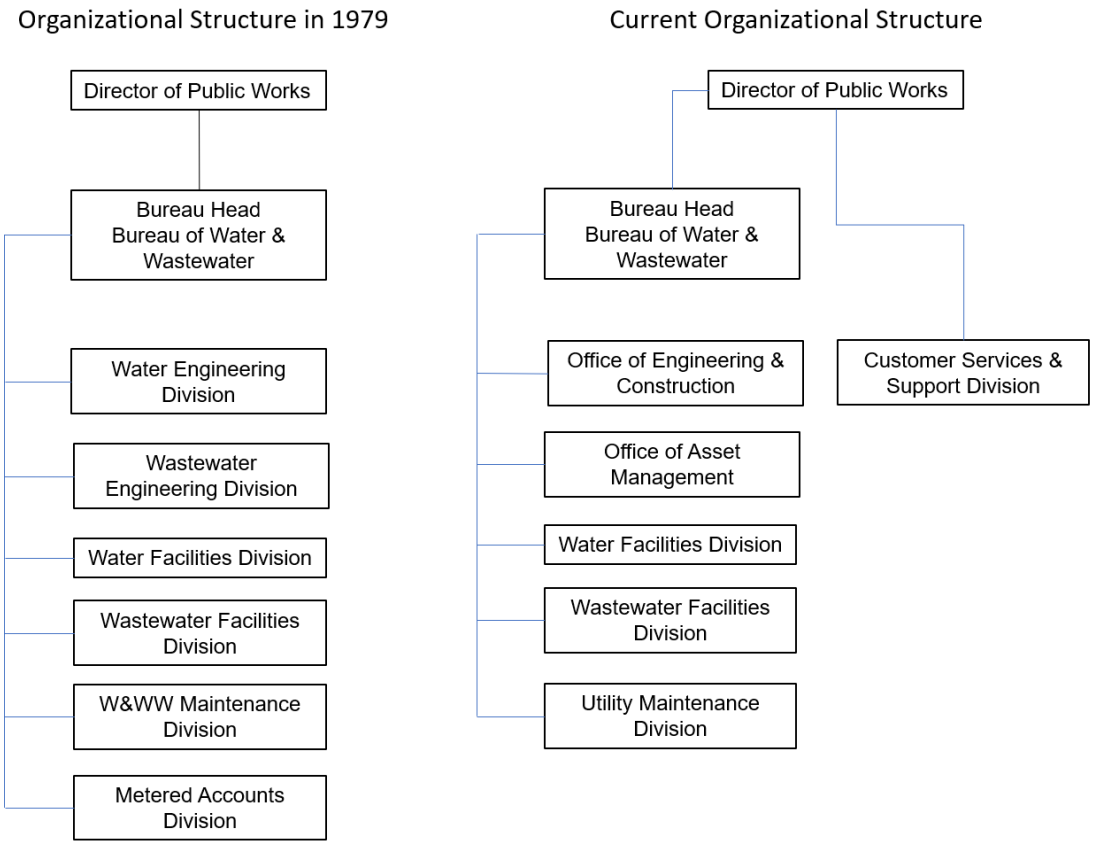
TASK 2.1 - CITY ORGANIZATIONAL STRUCTURE

MAJOR CITY FUNCTIONS AND RESPONSIBILITIES BY AGREEMENT

The current organizational structure of the City's water and wastewater utilities has its origins in a 1925 ordinance that brought the municipal government's engineering, construction, and maintenance departments under one Director. This ordinance eliminated various boards and commissions and consolidated the departments having like functions. With this action, authority over the municipally owned water supply was shifted from the Water Board to the City's Board of Estimates. The Water Department was renamed the Bureau of Water Supply, and the City's Chief Water Engineer became a direct report to the Director of Public Works. The Chief Water Engineer remained an appointee of the Mayor, subject to City Council approval.

Under the Department of Public Works' reorganization, which became effective on March 15, 1968, the Bureau of Water Supply became non-existent, and its various functions were assigned to three new bureaus: The Bureau of Engineering, the Bureau of Utility Operations, and the Bureau of Consumer Service. A later reorganization of the Department of Public Works, which went into effect in 1979, consolidated the three bureaus into a single entity: The Bureau of Water & Wastewater. The impetus for this reorganization was the adoption of ordinances that established the water and wastewater operations' finances as enterprise funds. The new bureau was made up of six divisions: Water Engineering, Wastewater Engineering, Water Facilities, Wastewater Facilities, Water and Waste Water Maintenance and Metered Accounts. The Bureau of Water and Wastewater structure remained largely unchanged until a significant re-organization of the Department of Public Works in 2014. These changes to the City's water and wastewater operations' organizational structure are depicted in the exhibit below.

Exhibit 2-2. City Organizational Structure Changes



One of the critical implications of DPW's new organizational structure is that it moved management and oversight of the utility from a functional basis that segregated water supply activities from wastewater activities to a combined utility model designed to eliminate functional redundancies across organizational lines.

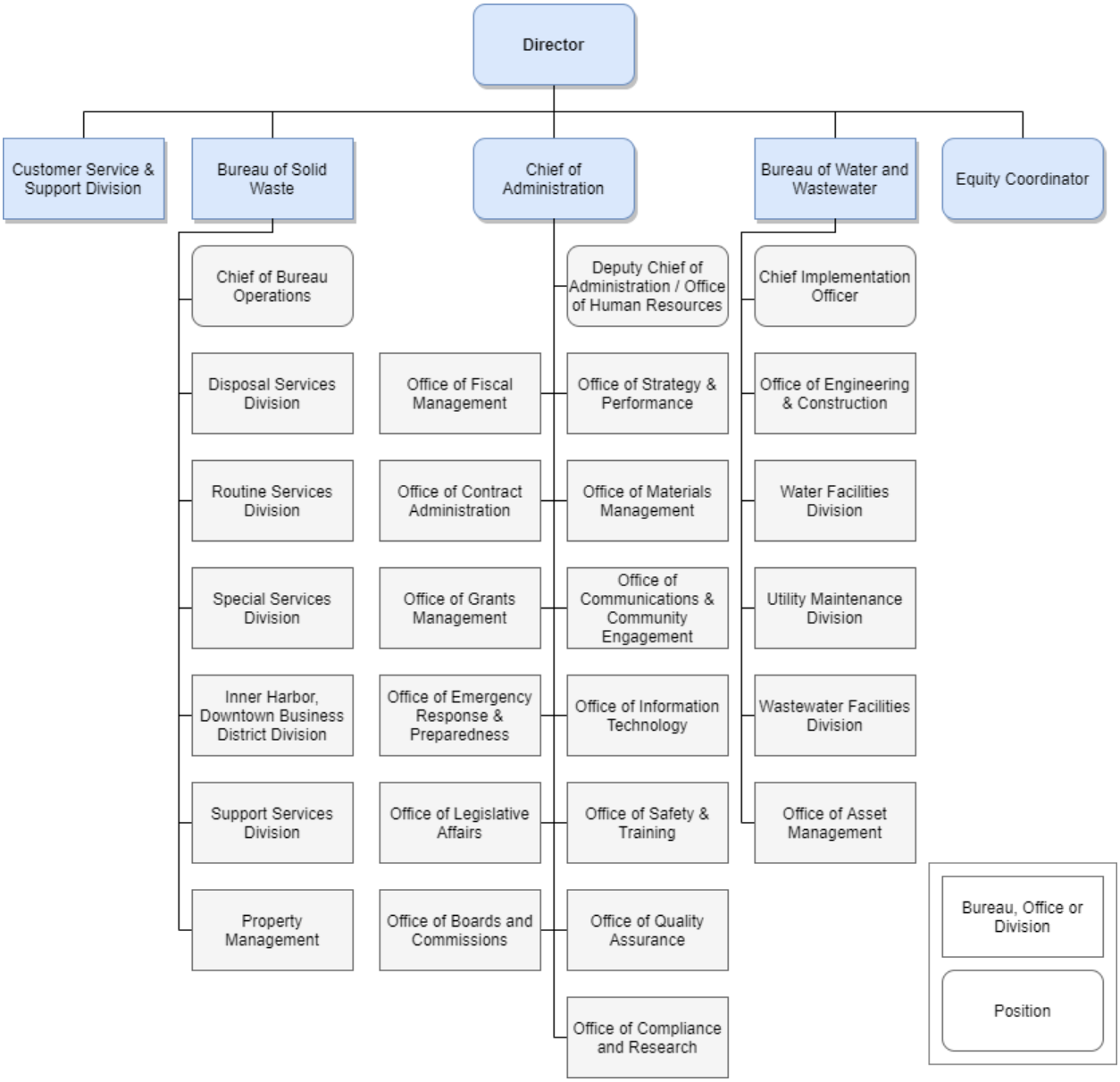
Organizational Structure

Baltimore City Department of Public Works

In addition to providing planning, construction and maintenance services to support the public infrastructure, the Baltimore City Department of Public Works (DPW) is responsible for providing safe drinking water and keeping waterways clean. The Department is led by the Director of Public Works, responsible for the executive management and overall direction, operation, maintenance, planning and continuous improvement of all functions of the Department.

An organizational chart for the City DPW (updated in the third quarter of CY [calendar year] 2020) is shown in the following exhibit.

Exhibit 2-3. Baltimore City Department of Public Works Organizational Chart



As shown in the exhibit, the span of control for the Baltimore City Director of Public Works consists of the following six direct reports (organizational units or positions):

- Bureau of Solid Waste
- Bureau of Water and Wastewater
- Customer Service & Support
- Chief of Administration
- Equity Coordinator

The organizational chart was recently revised in late 2020. A summary of some of the most significant changes made to the chart include:

- Removal of the Utility Manager position so that the Customer Service & Support Division reports directly to the Director of Public Works

- Removal of the Chief of Staff position
- Transfer of reporting of the Office of Engineering & Construction and the Office of Asset Management from the former the Chief of Staff position to the Bureau of Water and Wastewater
- Transfer of reporting of the remaining offices from the former Chief of Staff position to the Chief of Administration position
- Creation of a Deputy Chief of Administration / Office of Human Resources position that reports to the Chief of Administration position
- Change of name from Environmental Services Division to Water Facilities Division within the Bureau of Water and Wastewater

Below is a description of the central organizational unit responsible for providing water and wastewater services within the City: the Bureau of Water and Wastewater.

Bureau of Water and Wastewater

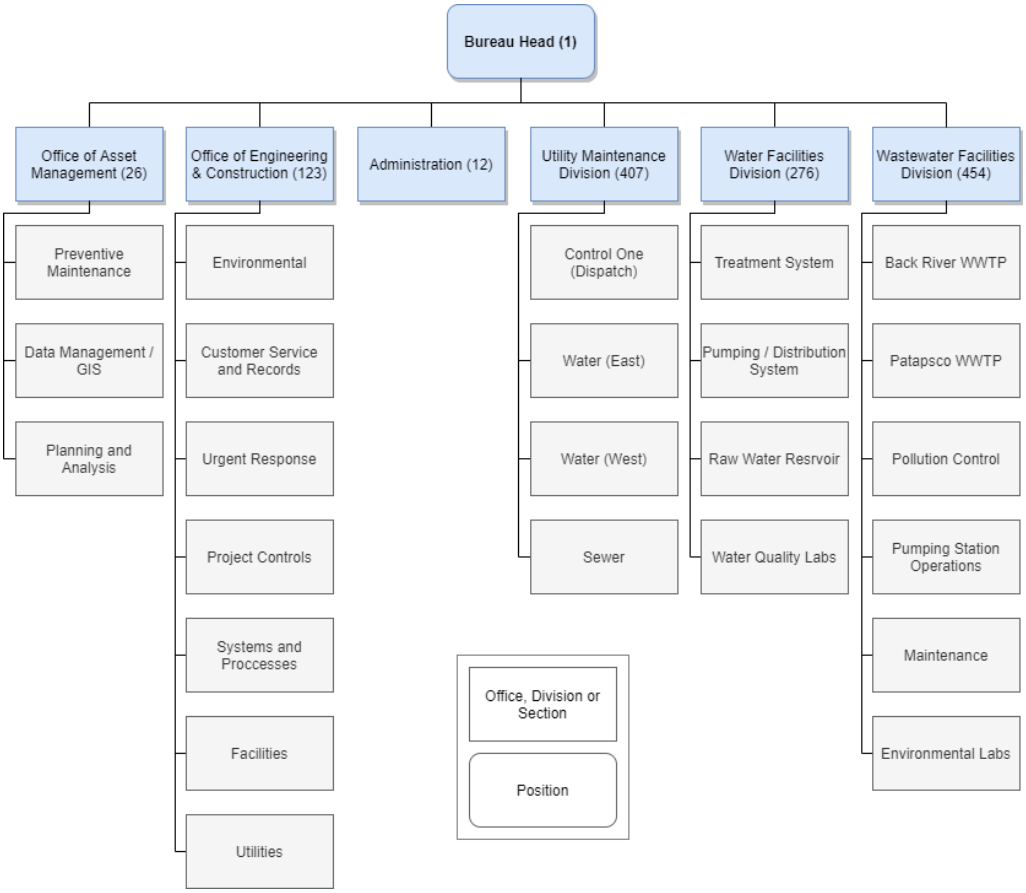
The Bureau of Water and Wastewater (BWW) oversees the production and transportation of drinking water and the collection and treatment of wastewater. The Bureau also manages the metering and billing of approximately 412,000 retail accounts in Baltimore City and Baltimore County and wholesale accounts for Carroll, Anne Arundel, Harford and Howard Counties.

The Bureau is in charge of the City water supply and all related properties, reservoirs, streams, pumping stations and mains. The Bureau operates three reservoir watersheds (Loch Raven, Prettyboy and Liberty), three water filtration plants (Montebello I, Montebello II and Ashburton) and two wastewater treatment plants (Back River and Patapsco).

The Bureau is led by the Head of the Bureau of Water and Wastewater.

An organizational chart for the Bureau of Water and Wastewater (updated in the third quarter of CY 2020) is shown in the following exhibit (with the number of filled positions in parentheses for each organizational unit).

Exhibit 2-4. Baltimore City Bureau of Water and Wastewater Organizational Chart



As shown in the exhibit, the span of control for the Head of the Bureau of Water and Wastewater consists of the following direct reports:

- Administration
- Office of Asset Management
- Office of Engineering & Construction
- Utility Maintenance Division
- Water Facilities Division
- Wastewater Facilities Division

Below is a description of each of these direct reports.

Administration

Administration is responsible for office administration and coordination and management analysis. Administration is led by the Head of the Bureau and includes 12 other positions. The following direct administrative positions report to the Head of the Bureau:

- Engineer Supervisor (with Lab QA Manager and Learning & Development as direct reports)
- Chief Implementation Officer (with three Sewer/Storm Support Leads as direct reports)
- Program Compliance Officer II (with three Water Support Leads as direct reports)
- Administrative Assistant I (there is also a vacant Administrative Assistant II position)

Office of Asset Management

The Office of Asset Management (OAM) is responsible for improving the service life of sewer and water linear infrastructure through proactive inspection and preventative maintenance. The Office implements a strategic approach to managing these assets at a sustainable cost and acceptable risk level.

Office of Engineering and Construction

The Office of Engineering and Construction (OEC) is responsible for planning and overseeing the layout, construction, contract administration and inspection of utility infrastructure. The Office also inspects dams, bridges and water and wastewater treatment facilities to make sure they are up to code according to the capital improvement plan. Office engineers draft contracts to create and maintain water and wastewater treatment plants, pumping stations and the collection and conveyance system.

There are several sections, each with specific responsibilities: Environmental carries out the City's MS4 (municipal separate storm sewer system) projects and maintains the City's stormwater system; Customer Service and Records provides as-built drawings and other records to customers, provides approval of Baltimore County developer agreements, coordinates contractor shutdown requests under the Wachs contract and reviews and coordinates inter-agency projects; Urgent Response provides as-needed assistance to respond to urgent water and wastewater issues; Projects Controls provides support to the project delivery teams by reporting and collecting data and analyzing project schedules; Systems and Processes provides audits of the projects within the Office and helps select consultants; Facilities maintains the City's water and wastewater facility infrastructure; and Utilities maintains the City's water and wastewater utility infrastructure.

Utility Maintenance Division

The Utility Maintenance Division (UMD) is responsible for providing water, sewer and storm utility services for Baltimore City. The Division performs preventative and planned maintenance on the City's collection and distribution systems, including repairing water main breaks, inlet cleaning, fire hydrant service and repair, CCTV of sewer lines, surface repair, valves operations and utility investigations. The Division consists of a dispatch section (Control One), two water sections broken down by geographic service area (East and West) and a sewer section.

Water Facilities Division

The Water Facilities Division (WFD) is responsible for treating and distributing safe drinking water through environmentally friendly measures. It is made up of four sections: Water Treatment treats source water to produce safe drinking water that meets federal and state regulations; Raw Water Reservoir monitors the three source water reservoirs (Liberty, Pretty Boy and Loch Raven) and maintains the City-owned land, roads, dams and infrastructure within the reservoir watersheds; Water Pumping ensures that plant production reaches consumers by overseeing 21 pumping stations and 20 storage tanks; and Water Quality Labs provide laboratory services for the water treatment plants.

Wastewater Facilities Division

The Wastewater Facilities Division (WWFD) is responsible for the operation and maintenance of the Back River and Patapsco wastewater treatment plants. The Division ensures the effluent from the two plants meets the standards set forth by the National Pollutant Discharge Elimination System (NPDES) permit regulated by the Maryland Department of the Environment (MDE). The Division is also responsible for twelve wastewater pumping stations and regulates all industrial wastewater discharge to the municipal sanitary sewer system and assesses charges for pollutants under the federal user charge program. This Division also includes the Wastewater Quality Labs.

Primary DPW Support for the Bureau of Water and Wastewater

While they do not report directly to the Head of the Water and Wastewater Bureau, the following offices provide support to the Bureau.

Office of Compliance and Research

The Office of Compliance and Research enforces environmental regulatory compliance for the Department. The Office was created when several functions were consolidated in 2014. The Office's staff primarily consists of engineers, scientists, and planners and is spread among laboratories located at each water and wastewater treatment facility. The Office is composed of four sections: Plans Review and Inspections, Water Quality Monitoring and Investigations, Watershed Planning and Partnerships and Research and Technical Resources.

Office of Fiscal Management

The Office of Fiscal Management oversees the preparation and monitoring of DPW's operating and capital budgets, rates and financial forecasting, capital project financing, procurement and inter-jurisdictional cost-sharing agreements.

Office of Legal and Regulatory Affairs

Working with the Baltimore City Law Department, the Office of Legal and Regulatory Affairs (OLAR) specializes in environmental compliance issues. OLAR assists DPW in responding to claims, litigation, subpoenas and Public Information Act (PIA) requests. In partnership with the Law Department, the Office represents DPW in negotiations with State and federal regulatory agencies, including the MDE and the U.S. Environmental Protection Agency (EPA). The Office also advises DPW on routine administrative violations and appeals administered by DPW, including stormwater, erosion and sediment control violations.

Office of Legislative Affairs

The Office of Legislative Affairs is responsible for partaking in policy analyses. It is the intermediary between DPW and elected officials at the City, State and federal levels, collaborating with the Mayor's Office of Government Relations. All legislative proposals and positions either begin with or are processed by the Office.

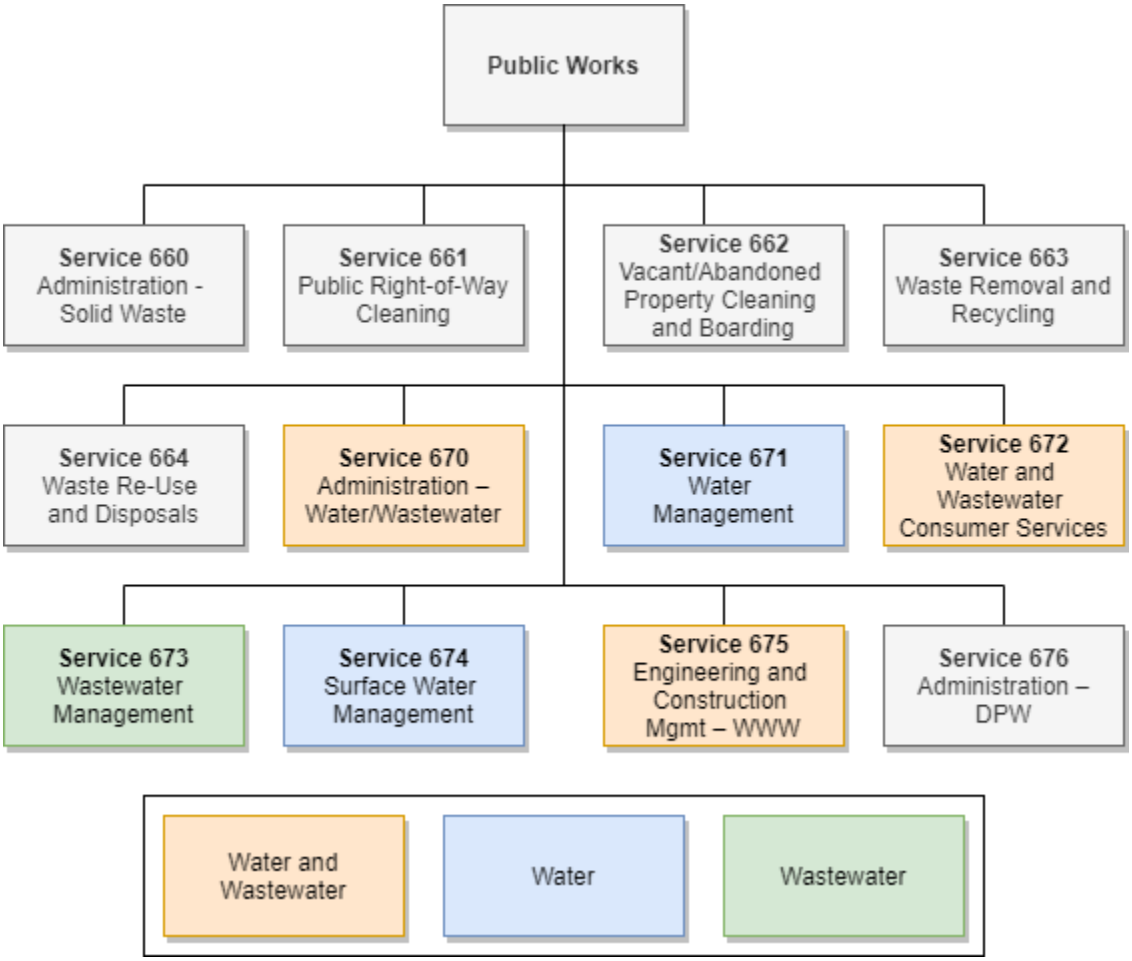
Office of Strategy and Performance

The Office of Strategy and Performance (OSAP) provides assistance and takes the lead in making sure vital projects and programs have thorough advanced planning, ensuring that each implementation step is well supported, managed, tracked and monitored from conception to completion. OSAP compares project and program outcomes with the desired objectives to help identify where improvements may be needed to secure even better performance. It is the role of OSAP to guide the application of industry best practices.

FY 2021 Budget

Within the City's FY 2021 recommended budget, the Department of Public Works is broken down into the following 12 services:

Exhibit 2-5. Baltimore City Department of Public Works Services



As shown in the exhibit, six services are directly related to water (blue boxes), wastewater (green boxes) or water and wastewater (orange boxes). Service 676 (Administration-DPW) is also involved in providing water and sewer service. Below is a description of each of these services.

Service 670: Administration – Water/Wastewater

Water and Wastewater Bureau Administration is charged with oversight, direction and support for water and wastewater operations.

The FY 2021 Board of Estimates (BOE) recommended administration budget is $44.88 million, a decrease of $7.74 million over the FY 2020 budget. The amount of the administration budget allocated to the water utility is $18.38 million (a decrease of $4.24 million over the FY 2020 budget). The amount allocated to the wastewater utility is $26.50 million (a decrease of $3.50 million over the FY 2020 budget). According to the budget, the reduction in funding is driven by an adjustment for central City services charges based on current expenditures and decreases in contractual services and the cost of retiree health benefits.

Service 671: Water Management

Water Management provides for the operation of the water distribution system in the Baltimore metropolitan region. This includes the maintenance of three watershed systems, three filtration plants, numerous pumping stations and over 4,500 miles of water distribution mains. This service also maintains the 23,000 fire hydrants within the City.

The FY 2021 BOE recommended water management budget is $86.93 million, an increase of $1.03 million over the FY 2020 budget. Other than $200,000 funded by the Federal government, the budget for this service is allocated entirely to the water utility.

Service 672: Water and Wastewater Consumer Services

Water and Wastewater Consumer Services provides timely and accurate meter reading and billing of 412,000 water accounts. Responsibilities include installation and maintenance of water meters, delinquent turn-offs and utility billing customer service. The service includes responsibilities to provide customer support for customer inquiries and escalated complaints and make necessary adjustments to bills for consumers through a mediation process. The service also provides for the management of the senior and low-income assistance programs.

The FY 2021 BOE recommended budget is $28.56 million, a decrease of $5.20 million over the FY 2020 budget. The budget is split into three separate utilities: water, wastewater and stormwater. The FY 2021 BOE recommended budget for the water utility is $10.93 million (a decrease of $5.29 million over the FY 2020 budget), for the wastewater utility is $13.47 million (an increase of $92,000 over FY 2020) and for the stormwater utility is $4.16 million (which remains unchanged from FY 2020).

Service 673: Wastewater Management

Wastewater Management provides for the collection and treatment of wastewater from the Baltimore metropolitan region. This includes operation and maintenance of the Back River and Patapsco wastewater treatment plants, 12 wastewater pumping stations and 1,400 miles of sewer main in the City.

The FY 2021 BOE recommended budget for wastewater management is $127.91 million, a decrease of $15.10 million over the FY 2020 budget. Other than $300,000 being funded by the State of Maryland, this service's budget is allocated entirely to the wastewater utility.

Service 674: Surface Water Management

Surface Water Management is responsible for preserving the City’s streams, harbor and the Chesapeake Bay; it accomplishes these goals by protecting water quality, controlling storm runoff, managing artificial groundwater recharge and controlling sediment. The service maintains 1,146 miles of storm drain pipe, 52,438 inlets, 27,561 manholes, 1,709 outfalls, four stormwater pumping stations and five debris collectors. The service encompasses activities that contribute to advancing the Baltimore City Sustainability Plan and the City-County Watershed Agreement.

The FY 2021 BOE recommended budget is $28.49 million, an increase of $7.97 million over the FY 2020 budget. The budget for this service is predominantly allocated to stormwater. The budget for stormwater is $25.69 million, an increase of $7.71 million over FY 2020. The budget for wastewater is $1.74 million (an increase of $21,000). The remaining $1.06 million of the budget is paid by the water utility, the federal government and the State.

Service 675: Engineering and Construction Management - Water and Wastewater

This service provides for the design, construction and management of water, wastewater, stormwater and environmental restoration capital improvement projects. To comply with the federal consent decree

that has been in place in the City since 2002, Engineering and Construction assists the City in upgrading its sewerage system to eliminate sewer overflows and other discharges.

The FY 2021 BOE recommended budget is $186.70 million, an increase of $29.69 million over the FY 2020 budget. The amount of the budget allocated to the water utility is $84.25 million (an increase of $16.84 million over the FY 2020 budget). The amount allocated to the wastewater utility is $102.46 million (an increase of $12.85 million over the FY 2020 budget). The majority of the budget is the debt service for capital improvement projects.

Service 676: Administration - DPW

While not directly related to water or sewer service, DPW Administration provides leadership and support to DPW through administrative direction, human resources, fiscal management, IT, contract administration, legislative affairs, media and communications, safety and training strategy and performance. These functions are supported financially by the Bureau of Water and Wastewater and the Departments of General Services and Transportation.

The FY 2021 BOE recommended budget is $4.28 million, an increase of $1.47 million over the FY 2020 budget. Of this amount, $2.83 million is allocated to the general fund (an increase of $23,000), and $1.45 million is allocated to the wastewater utility fund (all of which is newly budgeted).

Key Findings and Observations

- With the recent approval of a City Charter amendment, a City Administrator position was created. It is anticipated that Baltimore's new Chief Administrative Officer (CAO) will assume more responsibilities for City-County water and sewer issues.
- The functional roles and responsibilities of the divisions and offices depicted in the organizational chart cannot be reconciled with the services described in the City's budget. It is not clear where each position from the organizational chart is located within the services listed in the budget.
- Studies have shown the typical span of control for a competent manager within a water and wastewater utility is five to seven direct reports. According to the City's revised DPW organizational chart, the Director currently has five direct reports. According to the BWW's detailed organizational chart, the Bureau head has five divisions or offices as direct reports plus another three administrative position direct reports.
- When the Chief of Staff position was removed, the Chief of Administration took on a very high span of control. Based on the revised organizational chart, the Chief of Administration now has 13 offices as direct reports. With the addition of a Deputy Chief of Administration, it is possible some offices will report to the Deputy Chief. If that is the case, it is not depicted on the organizational chart.
- The recent move of the Office of Engineering & Construction and the Office of Asset Management makes sense as most of the roles and responsibilities within those offices are water and wastewater related.
- There is a desire to create a more regional approach to the organization of the Utility Maintenance Division, with organizational units for Westside City, Eastside City and County maintenance. This appears to already have been partially implemented as there are currently Water (East) and Water (West) organizational units.
- The Raw Water Reservoirs' responsibility under the Water Facilities Division manages 24,580 acres of watershed (including the Loch Raven, Prettyboy and Liberty reservoirs). It was reported that this unit has been underfunded for years. Due to a lack of funding, forest buffer around the reservoirs has decreased, and enforcement of rules and regulations regarding use of the land and waterways within the watershed have not been enforced to the extent desired.

- It was reported that the maintenance of meters should be moved from the Customer Service & Support Division (CSSD) to the Utility Maintenance Division since UMD is responsible for maintaining and repairing utility infrastructure and CSSD is more focused on billing and customer service.
- There is a desire by City and County DPW management to develop a formal structure or process to better coordinate water and sewer billing and customer service issues. While a joint office structured like the Water Analyzer Office would be ideal, it may be challenging to implement given the social distancing requirements of COVID-19.
- In February 2020, the Director of Public Works retired. The current Director has served in an acting capacity since then. The retirement of a prominent leader, and the uncertainty of hiring a replacement, can be challenging for any organization. This is amplified by the fact that the City is in the throes of dealing with a pandemic.

Task 2.2 - County Organizational Structure

Major County Functions and Responsibilities by Agreement

Under the various agreements discussed above, the allocation of responsibilities to Baltimore County for planning, design, construction and operation are as follows:

- Responsible for water system components that benefit only Baltimore County
- Responsible for wastewater collection system and related assets within Baltimore County
- Responsible for the operation of the wastewater conveyance system in Baltimore County

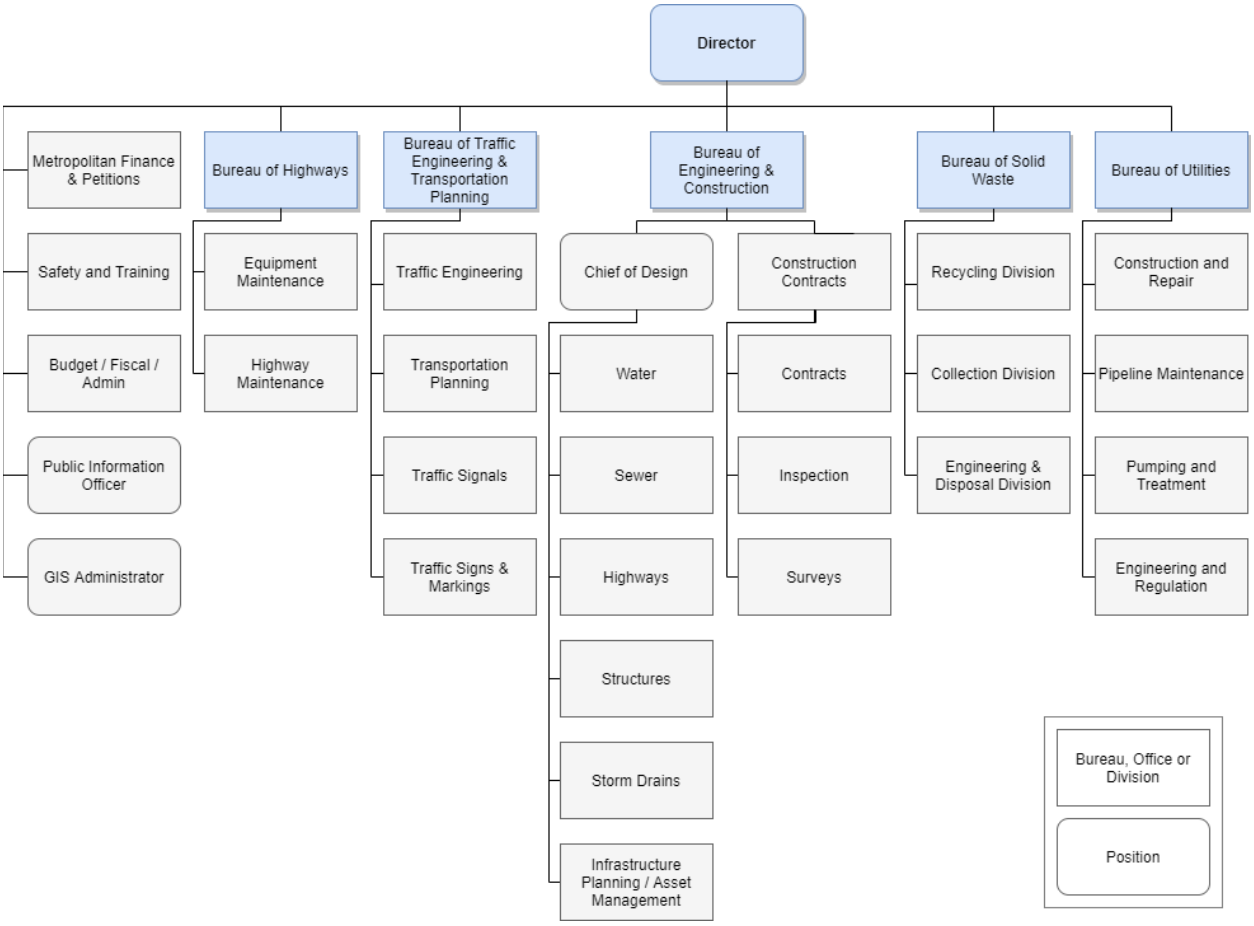
Organizational Structure

Baltimore County Department of Public Works

The Baltimore County Department of Public Works is responsible for water and sewer activities in the County and a myriad of other responsibilities required to maintain the County's infrastructure and support future growth. The Department is led by the Director of Public Works, responsible for the overall direction, operation, maintenance, forecasting, planning and continuous improvement of all Department functions (including transportation, utilities and solid waste operations).

An organization chart for the County DPW is shown in the following exhibit.

Exhibit 2-6. Baltimore County Department of Public Works Organizational Chart



As shown in the exhibit, the span of control for the Baltimore County Director of Public Works consists of the following ten direct reports (organizational units or positions):

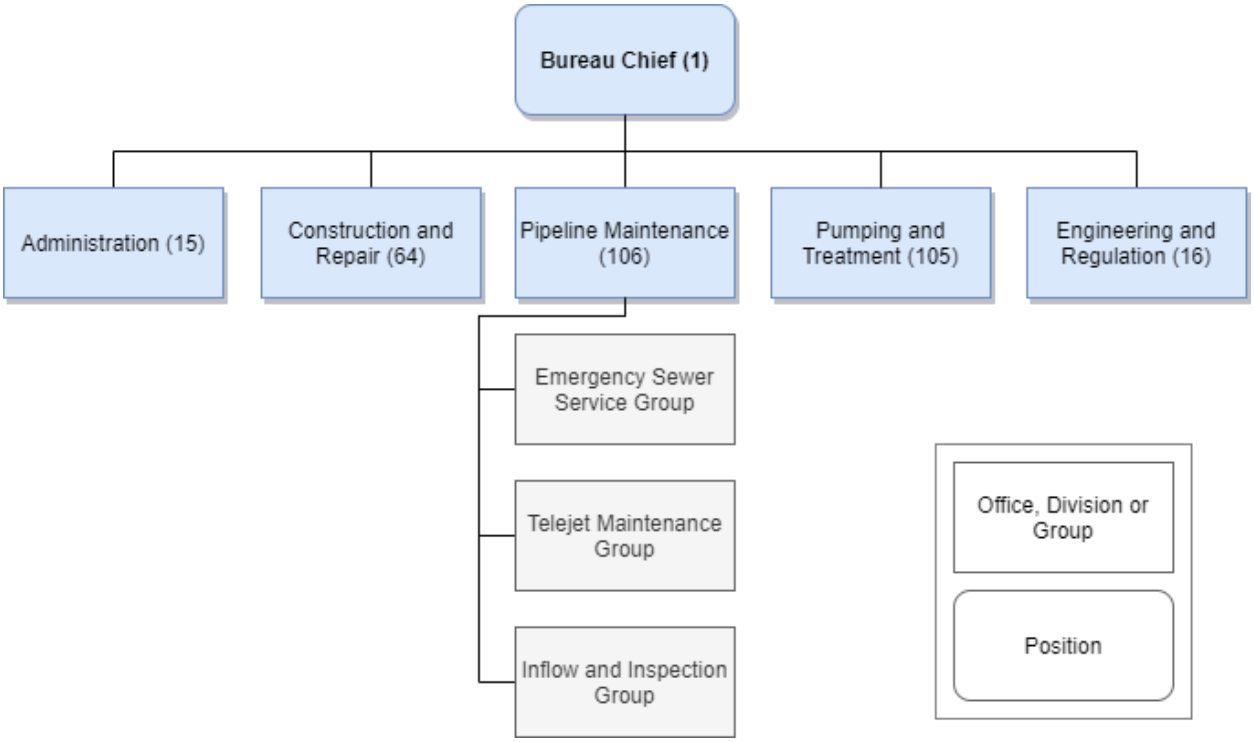
- Bureau of Highways
- Bureau of Traffic Engineering & Transportation Planning
- Bureau of Engineering & Construction
- Bureau of Solid Waste
- Bureau of Utilities
- Metropolitan Finance & Petitions
- Safety and Training
- Budget/Fiscal/Admin
- Public Information Officer
- GIS Administrator

Below is a description of the central organizational unit responsible for providing water and wastewater services within the County: the Bureau of Utilities.

Bureau of Utilities

Water and sewer services are predominantly provided by the Bureau of Utilities. The Bureau is headed by the Chief of the Bureau of Utilities. An organizational chart for the Bureau of Utilities (with the number of filled positions in parentheses for each organizational unit) is shown in the following exhibit.

Exhibit 2-7. Baltimore County Bureau of Utilities Organizational Chart



As shown in the exhibit, the span of control for the Chief of the Bureau of Utilities consists of the following direct reports:

- Administration Division
- Construction and Repair Division
- Pipeline Maintenance Division
- Pumping and Treatment Division
- Engineering and Regulation Division

Below is a description of each of these direct reports:

Administration

The Division is responsible for office administration, office coordination and management analysis.

Construction and Repair Division

The Construction and Repair Division is responsible for providing labor and equipment to repair sewer pipelines and underground portions of the storm drainage system. To accomplish this, the Division performs the following duties:

- Support City repair crews in the repair of broken water mains and valves
- Repair sanitary sewer manhole covers and sewer gravity and force mains
- Repair storm drain manhole covers, inlet boxes and lines
- Protect existing pipelines exposed by storm-related flooding
- Maintain frost-free hydrants
- Install and maintain steel road plates

Pipeline Maintenance Division

The Pipeline Maintenance Division is responsible for inspection and cleaning of the County sewage collection system, which handles approximately one billion gallons of wastewater per year through its network of 3,000 miles of pipeline, 116 pumping stations and 60,000 manholes. The Division performs the following duties:

- Inspect and maintain the gravity sewer collection system
- Inspect and clean storm drain inlet boxes and drainage pipes
- Respond to emergency calls to replace manhole covers, relieve sewer backups and overflowing manholes
- Conduct pipeline inspections utilizing closed-circuit television, smoke testing and dye testing
- Use cleaning equipment to clear blockages and debris from sewers and storm drain pipes
- Administer the fats, oil and grease (FOG) program

The Division is made up of three groups, each with specific duties. The Telejet Maintenance Group inspects and cleans sanitary sewer mains, storm drains, manholes and house connections. The Group also manages the FOG program and opens and cleans mainline stoppages during the day and performs spot repairs to sanitary sewers. The Inflow and Inspection Group performs inspections of newly constructed sewer and storm drains. The Group investigates complaints concerning storm drainage and sewers, repairs leaking joints and installs meters to determine inflow and infiltration problems. The Emergency Sewer Service Group investigates customer complaints regarding emergency sewer services and eliminates dangerous conditions until corrective action can be taken. The Group relieves house sewer connection stoppages in the public portion of the sewer system, mops basements when sewer mains overflow, locates clean-outs and opens mainline blockages at night and marks 14-inch diameter or larger mains for Miss Utility.

Pumping and Treatment Division

The Pumping and Treatment Division is responsible for the operation and maintenance of the County's pumping station and treatment facility infrastructure, consisting of 224 pumps located at 112 sewage pumping stations, one community sewage treatment plant, three treatment and water distribution systems and approximately 2,500 grinder pump stations. The Division performs the following duties:

- Maintain and operate all pumps, valves, air compressors, chlorinating devices, metering instrumentation and engines in the collection system and at the sewage treatment plant in compliance with State and Federal regulations
- Perform around-the-clock inspections and preventive maintenance to pumping station electrical and mechanical systems
- Perform electrical and mechanical maintenance of grinder pumps in certain areas of the County

Engineering and Regulation Division

The Engineering and Regulation Division is responsible for managing, permitting and enforcing the Wastewater Monitoring and Analysis Program to comply with MDE and EPA regulations.

Primary DPW Support for the Bureau of Utilities

While they do not report directly to the Chief of Utilities, the following offices support the Bureau.

Metropolitan District Finance & Petitions Office

The Metropolitan District is a geographical area in the County where property owners can receive public water and sewer service. The geographical District boundary originated in the 1920s and 1930s, along with subsequent annexations.

The District operates as a self-sustaining fund, not part of the Baltimore County operating or capital budgets. The District receives revenues from net proceeds on the sale of water, water service and sewer service. The District provides funds to the Bureau of Utilities for the operation and maintenance of water and sewer assets located within its boundaries.

The Metropolitan District Finance & Petitions Office (Metro) is responsible for assessing and billing customer charges within the Metropolitan District. Specifically, the Office is responsible for the following:

- Respond to and process inquiries for water and sewer availability and requests for petitions to extend public sewer and water lines
- Administer and coordinate design and construction of health-related and citizen-financed projects for sewer and water lines with other County agencies, secure methods of funding and repayment and conduct public meetings to explain costs and payment options available to property owners
- Determine water and sewer charges appearing on annual tax bills based on water consumption reported by the City
- Calculate and bill a food service surcharge for foodservice businesses
- Bill industrial wastewater surcharges
- Calculate and administer wastewater credit allowances, including residential swimming pool wastewater credits

DPW Safety Office

The DPW Safety Office is not part of the Bureau of Utilities, but it plays a significant role in the Bureau's success. The Safety Office conducts safety training, worksite safety inspections, accident investigations and establishes safety procedures and protocols. Until recently, the Bureau budget funded two safety officers, and one officer was effectively working full-time on water/wastewater safety needs. The Safety Office also manages the Training Academy, which assists the Bureau by improving employee work skills.

Department of Permits, Approvals and Inspections

A separate department from Public Works, the Department of Permits, Approvals and Inspections (PAI), processes all permitting and development requests, reviews and approves all construction documents and enforces all housing and zoning codes. The Department also collects water and sewer connection fees and prorated water and sewer charges. Several programs within PAI are partially funded by Metro: General Administration, Real Estate Compliance and Development Review.

FY 2021 Budget

Within the County's FY 2021 proposed budget, the following Department of Public Works programs are involved in providing water and sewer service.

- 7001 General Administration (Office of the Director)
- 7006 Metro Financing & Petitions
- 7203 Sewer and Water Main Design
- 7801 General Administration (Bureau of Utilities)
- 7802 Engineering & Regulation
- 7803 Sewer/Water Operations/Maintenance
- 7804 Pumping/Treatment Plant Operations/Maintenance

Below is a description of each of these services.

7001: General Administration (Office of the Director)

While not directly related to water or sewer service, DPW Administration provides management, administrative and engineering review services to all Department employees. The FY 2021 budget for DPW Administration is $21.22 million, an increase of $1.53 million over the FY 2020 budget. Roughly 41% of DPW Administration is funded from Metro charges, with the remaining 59% funded by the General Fund. It should be noted that over $18.0 million of this budget is an indirect cost allocation charge to Metropolitan District Financing & Petitions for General Fund programs supporting the enterprise system.

7006: Metro Financing & Petitions

Reporting to the Office of the Director, Metropolitan District Financing & Petitions (Metro) provides water and sewer, assessment and billing services and utility petition process services to property owners within the County's Metropolitan District to ensure access to public water supply and public sanitary sewer disposal. The FY 2021 budget for Metro is $1.03 million, an increase of $0.24 million over the FY 2020 budget. About 93% of this program is funded from Metro charges, with the remaining 7% funded by the General Fund.

7203: Sewer and Water Main Design

Reporting to the Bureau of Engineering & Construction, Sewer and Water Design provides engineering design and review services supporting the capital budget for sanitary sewers and water systems. The FY 2021 budget for the program is $2.73 million, an increase of $0.49 million over FY 2020. 100% of this program is funded from Metro charges.

7801 General Administration (Bureau of Utilities)

General Administration within the Bureau of Utilities provides operational and managerial oversight to the Bureau of Utilities to maintain and operate the sanitary sewer and storm drain systems. The FY 2021 budget for the program is $1.12 million, an increase of $0.54 million over the FY 2020 budget. 100% of this program is funded from Metro charges.

7802: Engineering & Regulation

Within the Bureau of Utilities, Engineering and Regulation enforces environmental regulations by issuing permits to users of the sanitary sewer system to comply with discharge regulations. The FY 2021 budget for this program is $1.30 million, an increase of $0.18 million over FY 2020. 100% of this program is funded from Metro charges.

7803: Sewer/Water Operations/Maintenance

Within the Bureau of Utilities, Sewer and Water Operations and Maintenance (also referred to as Pipeline Maintenance) provides cleaning, inspection and repair services to all properties connected to the sanitary sewer or storm drain systems. The FY 2021 budget for this program is $18.49 million, an increase of $0.39 million over FY 2020. 100% of this program is funded from Metro charges.

7804: Pumping/Treatment Plant Operations/Maintenance

Within the Bureau of Utilities, Pumping and Treatment Plant Operations and Maintenance provides maintenance and operation services for the water and wastewater treatment plants and sewage pumping stations. The FY 2021 budget for this program is $134.35 million, a decrease of $3.31 million over FY 2020. 100% of this program is funded from Metro charges.

In addition to those mentioned above, other programs within DPW and PAI that are partially Metro funded include the following (percentage Metro funded is listed, remainder is General funded):

- General Administration, PAI (Program 1701; 31% Metro funded)
- Real Estate Compliance, PAI (Program 1713; 31% Metro funded)
- Development Review, PAI (Program 714; 31% Metro funded)
- Safety Office, DPW (Program 7007; 41% Metro funded)
- General Administration, DPW (Program 7201; 50% Metro funded)
- Structural Storm Drain & Highway Design (Program 7205; 4% Metro funded)
- General Surveying (Program 7209; 49% Metro funded)
- Contracts/Construction Inspections (Program 7211; 34% Metro funded)
- General Operations & Maintenance (Program 7502; 0% Metro funded but an amount is included in the program budget for a charge off to Metro for utility road cuts)
- Equipment Maintenance (Program 7503; 11% Metro funded)

Key Findings and Observations

- Like the City, the bureaus and divisions' functional roles and responsibilities in the organizational chart are not easily reconcilable with the programs described in the County's budget. It is also not clear how budget programs are allocated between water and sewer funding and staffing.
- According to the County's DPW organizational chart, the Director currently has five direct reports. According to the Bureau of Utilities' detailed organizational chart, the Chief of the Bureau has four division direct reports plus another five or so administrative position direct reports.
- It was reported that a position from the Office of Budget and Finance (OBF) should be added within the Department of Public Works (most likely within Metro) as a liaison between OBF and DPW. There are very few individuals currently within OBF with knowledge of the operations of DPW.
- It was reported that with the FY 2021 budget, the Baltimore County Safety Office is part of the DPW organization reporting directly to the DPW Director of Public Works. However, the County Safety Policy states the Safety Office takes direction from the Directors of HR and Finance. Bureau supervisors believe this restructuring will reduce the safety support traditionally provided by the safety officer. The risk exists that the restructuring will distance the safety officers from the field supervisors and employees and create "silos" to the detriment of the safety program.
- During the early stages of the pandemic, the Bureau of Utilities observed social distancing requirements and operated with reduced field crews. This resulted in the deferral of non-urgent field maintenance. Over time, the Bureau has restored its field crews and is conducting emergency and preventive maintenance.
- It was reported that there are silos that hinder communication between departments and divisions. When a project is progressing through its life cycle, all stakeholders are not involved in the process. For example, when a project is being developed in Engineering that will eventually end up in Maintenance, Maintenance is not engaged in the process until they are notified, and it becomes their responsibility. While the different divisions do not mind communicating with each other, they do not do it as much as they should.
- There is a desire by City and County DPW management to develop a formal structure or process to better coordinate water and sewer billing and customer service issues. While a joint office structured like the Water Analyzer Office would be ideal, it may be challenging to implement given the social distancing requirements of COVID-19.
- At the end of May 2020, the Director of Public Works retired. There have been two acting directors since then. Like the City, the county has to deal with uncertainty from not having a permanent Director coupled with issues from COVID-19.

Task 2.3 - Coordinated City-County Governance Model

City-County Governance

Under the current governance framework outlined in the Acts of 1945, the 1972 Water Agreement, and the 1974 Sewer Agreement, the City and County are given discrete responsibilities and decision-making authority over discrete areas of the two utilities. These areas of functional responsibility are shown in the following exhibit.

Exhibit 2-8. Current Water and Wastewater City/County Governance by Function

Service	Major Function	Responsibility
Water	Rate Setting	County establishes, City implements
	Customer Billing	County for its Water Distribution Charge, City for other rates
	Raw Water Supply & Treatment	City
	System Maintenance & Operation	City
	Development Approval	Handled independently by each jurisdiction
	Water Facility Master Planning	Handled jointly through Water Analyzer Office
	CIP - Planning & Implementation	County for projects serving County customers, City for others
Wastewater	Rate Setting	Set independently by each jurisdiction
	Customer Billing	Handled independently by each jurisdiction
	Wastewater Treatment	City
	System Maintenance & Operation	Handled independently by each jurisdiction
	Development Approval	Handled independently by each jurisdiction
	Wastewater Facility Master Planning	Handled independently by each jurisdiction
	CIP - Planning & Implementation	Handled independently by each jurisdiction

Under the current governance framework, the City is responsible for the operation and maintenance of water distribution system and related assets (pumps, storage, etc.) for both the City and the Metropolitan District, all water filtration facilities, the wastewater conveyance systems within the City, and all wastewater treatment plants. The City is also responsible for billing and customer service for all water customers in the City and County. Water and wastewater rates, fees and charges for City customers are set by the City's Board of Estimates.

Baltimore County is responsible for the planning, design and construction of new water facilities that solely benefit County customers and the operation and maintenance of the County's wastewater conveyance system, including the sewage pumping stations. The County is responsible for billing and customer service related to wastewater service for County residents. It is also responsible for setting water and wastewater rates, fees and charges for County customers.

The following exhibit presents the City and County's organizational units responsible for significant water and sewer functions.

Exhibit 2-9. Major Functions for City and County

Function	City Unit	County Unit
Operations and Maintenance		
Water Supply	Treatment System Section and Raw Water Reservoir Section in Water Facilities Division (WFD) in Bureau of Water and Wastewater (BWW) in Department of Public Works (DPW)	N/A
Water Treatment	Treatment System Section, WFD, BWW, DPW	N/A
Water Transmission and Distribution	Pumping/Distribution System Section, WFD and Water (East) Section and Water (West) Section, Utility Maintenance Division (UMD), BWW, DPW	Pumping and Treatment Division, Bureau of Utilities (BOU), DPW
Wastewater Collection	Sewer Section, UMD and Pumping Station Operations Section in Wastewater Facilities Division (WWFD), BWW, DPW	Construction and Repair Division, BOU, DPW; Pipeline Maintenance Division, BOU, DPW; Pumping and Treatment Division, BOU, DPW
Wastewater Treatment	Back River WWTP Section and Patapsco WWTP Section, WWFD, BWW, DPW	Pumping and Treatment Division, BOU, DPW
Stormwater Collection	Stormwater Section, UMD and Pumping Station Operations Section in Wastewater Facilities Division (WWFD), BWW, DPW	Construction and Repair Division, BOU, DPW; Pipeline Maintenance Division, BOU, DPW
Stormwater Treatment	Back River WWTP Section and Patapsco WWTP Section, WWFD, BWW, DPW	N/A
Management, Engineering, Customer Service, Other		
Pretreatment Programs	Pollution Control Section, WWFD, BWW, DPW	Pipeline Maintenance Division, BOU, DPW
Engineering	Office of Engineering & Construction (OEC), BWW, DPW	Bureau of Engineering & Construction (BEC), DPW; Engineering and Regulation Division, BOU
Utility Planning	DPW Administration; OEC and Office of Asset Management (OAM), BWW, DPW; Office of Strategy and Performance (OSAP), Chief of Administration, DPW	DPW Administration; Administration Division, BOU; BEC, DPW
Lab Service/Compliance	WFD and WWFD, DPW	N/A
Customer Service/Call Center	Customer Service and Records Section, OEC, DPW; Customer Service & Support Division (CSSD), DPW	Metropolitan Finance & Petitions
Customer Billing	CSSD, DPW	Metropolitan Finance & Petitions

Exhibit 2-9. Major Functions for City and County

Function	City Unit	County Unit
Public Relations	Office of Communications & Community Engagement, Chief of Administration, DPW; Office of Legislative Affairs, DPW	Public Information Officer
Finance	Office of Fiscal Management, Chief of Administration, DPW	Metropolitan Finance & Petitions
Human Resources	Office of Human Resources, Chief of Administration, DPW	Office of Human Resources
IT	Office of Information Technology, Chief of Administration, DPW	Office of Information Technology
Facilities	Facility Maintenance Division, Department of General Services (DGS); Treatment System Section, WFD, WBB, DPW; Maintenance, WWFD, BWW, DPW	Pumping and Treatment Division, BOU, DPW; Property Management Division, Office of Budget and Finance
Fleet	Fleet Management Division, DGS	Bureau of Highways, DPW
Legal/Administration	Office of Legal & Regulatory Affairs, Law Department	Law Office
Safety	Office of Safety & Training, Chief of Administration, DPW	Office of Safety and Training, DPW
Risks/Claims	Office of Legal & Regulatory Affairs, Chief of Administration, DPW; Office of Risk Management & Division of Safety, Department of Finance (DOF)	Office of Safety and Training, DPW; Claims Management Division, Office of Budget and Finance
Security	Baltimore Environmental Police, Chief of Administration, DPW	N/A

Key Findings and Observations

- The City-centric governance framework established over 75 years ago did not anticipate that the region's population would dramatically shift to Baltimore County and away from the City. Today, Baltimore County accounts for more than half of the system's customer accounts, accounts for the system's service population, and most, if not all, of the growth in demand, is being driven by County development.
- The City's Director of Public Works has the exclusive authority to make decisions about almost every aspect of the water system, including billing and metering policies and procedures, budget and resource allocation, personnel hiring and terminations, organization structure, strategic priorities, management of the reservoirs and capital priorities. Under the current governance framework, the City and the Director of Public Works are not accountable to the County's customer service delivery, system reliability or operational efficiency.
- Because the current inter-jurisdictional agreements continue in full force and effect unless both parties agree to change provisions and enter into a new agreement, roles and responsibilities concerning operation and management of the water system cannot be changed unless both the City and County agree to the change or a legislative remedy is approved through the Maryland General Assembly.
- The current governance framework has been ineffective in resolving long-standing disputes over customer billing issues and annual water reconciliation.
- The current governance framework does not support a culture of continuous improvement and accountability with respect to customer service delivery, system reliability and maintenance responsiveness.
- The current structure does not support effective inter-jurisdictional communications across all levels of the two organizations. As a result, there is no evidence that true collaboration and cooperation are occurring between the City and County on essential matters such as strategic planning, long-range planning, capacity management, emergency response, regulatory compliance, service interruptions, service changes, safety issues or other emerging areas of concern.
- The current governance structure does not support the high level of coordination needed to project, plan and execute system improvements to meet growing demand in Baltimore County and other jurisdictions. Although the current framework identifies a joint planning office to be staffed by City and County personnel for this purpose, there is no requirement for either jurisdiction to provide resources to ensure that this function is performed effectively and efficiently.
- There is no oversight process defined in statute or agreement to ensure that the Director of Public Works' policies, procedures or decisions are in the best interest of both City and County customers. While decisions made by the City's Director of Public Works often receive approval through the City Board of Estimates or oversight by the Baltimore City Council, many of these decisions have far-reaching implications for Baltimore County customers, but there is no mechanism for review by County elected officials.
- The current governance structure has no requirement or mechanism to conduct strategic planning across jurisdictional boundaries. This means that planning functions within the utility are not aligned with the City or County's strategic goals and priorities.

Task 2.4 - Governance Model Examples and Case Reviews

Governance Model Examples

History of Governance for Water and Sewer Utilities in the United States

The inability of private wells to provide safe water in adequate amounts, combined with the increasing quantities of sanitary and industrial sewage, caused serious public health problems in the United States as the young country's cities grew rapidly. Initially, the provision of water was mostly a private sector "for-profit" activity. For example, the Chase Manhattan Company was organized in 1799 as a water company in New York before it morphed into a bank. The City of Baltimore chartered the Baltimore Water Company in 1792, the first water company in the nation. The first long-term debt for the City's water system was issued in 1804 and underwritten by Alex, Brown & Sons. Initially, domestic and industrial waste was drained into the closest body of water, which was often used as a water supply. This caused public health problems, most famously the cholera outbreak in Chicago caused when raw sewage was sucked into the intake for the City's water system located several miles offshore in Lake Michigan.

Public and Private Utility Ownership

Water and sewer utilities are generally classified into two categories of ownership:

- ***Municipally-Owned Utilities*** are generally operated on a non-profit basis and owned by a municipal entity or specialty organization created under applicable state law. For purposes of this discussion, co-operatively owned water systems (relatively rare), which are effectively owned by their customers, will be considered municipal. Municipal utilities generally raise capital via the issuance of long-term, generally tax-exempt, debt. Debt may be a general obligation of the owning municipality (if it has the authority to impose taxes) or revenue bonds backed solely by the utility's revenues. There are also numerous variations on debt backed concurrently by debt and good faith. Municipal debt is considered low-risk and is generally attractive to investors due to its dedicated revenue stream. Rates are usually proposed by the entity's staff and approved by its oversight body. In some states (e.g., Texas, Wisconsin, Maine, Kentucky), the state's public utility commission establishes rates for municipal water and sewer systems and investor-owned utilities.
- ***Privately-Owned Utilities*** are generally operated on a for-profit basis and owned by investors ("investor-owned utilities," or IOUs). They are also generally considered to be a specialized form of corporation and raise capital from investors. IOUs are subject to the same legal and regulatory requirements as municipal utilities, and their rates are established by the state regulatory utility commissions in the states in which they operate. There are a handful of large multi-jurisdiction IOUs (e.g., American Water, Aqua America, Veolia, etc.) and thousands of small IOUs, many of which are family-owned businesses in rural areas and small communities. Maryland has a handful of investor-owned water and sewer utilities, with rates controlled by the Maryland PSC. IOUs have the same costs as municipal utilities, plus the need to produce profits for investors.

Utility Partnerships

Within The Water Research Foundation's 2019 report, *Water Utility Partnerships: Resource Guide and Toolbox* (Project 4750), there are six generic regional partnership options for water (and wastewater) utilities. The exhibit below lists these partnership options in order of low to high transfer of responsibility.

Exhibit 2-10. Utility Partnership Options

Below is a description of each of these partnerships and some example forms of arrangement.

Mutual Aid Arrangements

Mutual aid arrangements consist of agreements between utilities to provide assistance during emergencies. It can take the form of lending of personnel, equipment or materials or temporary supply of water during crises. EPA's WARN (Water and Wastewater Agency Response Network) programs are an example of these types of arrangements developed at the state level. Maryland's WARN can be found at mdwarn.org.

Sharing Arrangement

A sharing arrangement is an agreement between utilities to share staff (operational, administrative or support), equipment or supplies. It may also consist of a joint purchasing agreement for equipment or supplies. Sharing of resources can lower overhead and allows for greater economies of scale. However, they also require the sharing utilities to make joint decisions about which resources to share, costs of the resources and allocation sharing them.

Wholesale service Purchase Arrangement

A wholesale service purchase agreement is an arrangement in which a wholesale supplier provides a service (e.g., water supply, wastewater treatment services) to one or more retail utility customers. In theory, having a wholesale service provider focusing on water supply or regional wastewater treatment should decrease the cost of providing service.

Collaborative Resource Development

Collaborative resource development consists of the creation of an entity that provides planning, supply or treatment services for member utilities within a region. This could include providing planning services at a regional level or operate a water or wastewater treatment system.

Contract Services Arrangement

A contract services arrangement consists of outsourcing various functions of the water and/or wastewater system to another utility for a specific period. Contract services may be provided by a private firm or another utility. Through contracted services, a utility could obtain skilled personnel at a lower cost than providing it internally. However, there could be perceptions that the utility would lose control of service, product quality or workforce.

Consolidation

Consolidation results in the highest transfer of responsibility of ownership and operation of one or more utilities or utility functions are transferred or merged into another utility. If the ownership of an entire utility is transferred, typically, the transferring utility is dissolved. Consolidation can be considered the ultimate form of regionalization. A successful merger consists of a centralized focus on providing water and/or wastewater services to a region that results in economies of scale, additional resources, improved customer service and lower customer bills than if the utilities had operated independently. Like many of these partnering agreements, the biggest concern is the perceived loss of control or local identity.

There is a greater tendency for regional consolidation in very large population areas. The regional agency allows for a special purpose self-supporting agency focusing on only a limited range of services, with no (or very limited) taxing authority, accountable to local governments via the process of appointing board members to the regional agency.

Legal Structures

The *Water Utility Partnerships* report also describes common legal structures that utility partnerships can implement when deciding to collaborate. Below is a description of each of these. At a minimum, most of these require a contract for the partnership to be agreed upon. More complex arrangements involve additional legal requirements.

Memorandum of Understanding

A memorandum of understanding (or memorandum of agreement) is a written agreement between utilities that documents the terms of the partnership. While it may not be legally binding, it is fairly simple to draft and is more formal than a verbal agreement.

Wholesale Service Purchase Agreement

A wholesale service purchase agreement is a contract for a utility to provide another with water or sewer services (e.g., water supply, wastewater treatment services). These are also relatively simple to set up but provide more legal assurance than an MOU.

Special District or Water/Wastewater Authority

A special district or water/wastewater authority is formed within a specific service area boundary to meet a specific purpose. Typically, special districts and authorities have the ability to charge rates and fees and issue revenue bonds.

Cooperative

Cooperatives are non-profit, private sector partnerships created to achieve a single goal. All customers of the cooperative are members, and each member has voting power. Cooperatives are often formed in rural areas.

Baltimore City and Baltimore County

As presented in this report, Baltimore City and County currently engage in several types of partnerships. With the 1972 and 1974 agreements, the City and County have agreed to forms of wholesale service purchase arrangements, collaborative resource development and contract services arrangements. According to the agreements, the City provides both the City and County the following services: raw water supply and treatment, water system operations and maintenance and wastewater treatment. In theory, water facility master planning for the City and County is a form of joint collaboration as it is to be funded

jointly by County and City staff within the Water Analyzer Office. Other services are the individual responsibility of each utility, such as development approval and setting of some rates and charges.

Case Reviews

Below are governance case reviews for the following jurisdictions:

- Cape Fear Public Utility Authority (CFPUA), North Carolina
- Washington Suburban Sanitary Commission (WSSC Water)
- DC Water
- City of Richmond and Henrico County, Virginia
- City of Charlottesville and Albemarle County, Virginia

These case reviews were selected to provide a range of governance and organizational models and present the lessons learned when developing utility partnerships. Also, all of the utilities in the case reviews are within relative proximity to Baltimore City and Baltimore County. For each case review, an overview of the governance model employed, a summary of the background, governance and organization of the utilities and lessons learned and key takeaways are provided.

Cape Fear Public Utility Authority, North Carolina

Governance Model

Consolidation of formerly independent City and County water and sewer utilities into a new independent authority (Consolidation; Water and Wastewater Authority)

Background

The first day of business for the Cape Fear Public Utility Authority (CFPUA) was July 1, 2008. The origins of the regional authority begin in 2005, an excellent year for the local economy.

The City of Wilmington had a Utility Department that operated a water treatment plant and two wastewater treatment plants. The City maintained an enterprise fund, a separate budget that depended solely on fees for both operating and capital cost funds. The fees and budgeted expenditures were annually voted upon by the City Council, and no taxes were used in the operation of the City's utility department.

The County's Engineering Department operated new Hanover County utilities. Drinking water was provided from wells, and wastewater was transported via County-owned pipes to the City-operated wastewater treatment plants. The County paid fees to the City to treat its wastewater. The County did not use the enterprise fund system. The County created the New Hanover Water and Sewer District in 1981, which had as its board of directors the New Hanover County Commissioners. The District utilized a combination of fees for service and county tax funds to operate its system. A growing economy had already necessitated upgrades to the City and County utility systems' infrastructure. The City was planning rate increases to pay the debt service for the upgrades. The County was also facing significant increases in utility costs and significantly increasing taxes. They had contacted the City Council on two or more occasions to discuss combining the two systems. No progress had been made in any of the joint meetings. The County continued to make a case for consolidating the two utilities; the City agreed that there could be an advantage to the community of a consolidated system and agreed to continue talks until it found a disadvantage to the City's taxpayers and utility customers. In January 2006, the City hired an engineering firm to study the situation. By October of 2006, both governments had voted to establish a "Joint Water Sewer Advisory Committee" and had appointed three members each. The joint committee met as often

as necessary, a consensus began to form, and the movement to create an independent authority gained steam.

The organization tasked with moving forward with consolidation was the Joint City/County Water and Sewer Advisory Committee. Once they made the recommendation to proceed with consolidation, they were given the job of overseeing the next steps in the process. This Committee tackled every phase of the consolidation. MFSG (the Municipal & Financial Services Group [now part of NewGen]) was hired to perform the studies and analyses required to build an effective authority. With their assistance, the Water and Sewer Advisory Committee oversaw the establishment of bylaws, the adoption of uniform water and sewer rates, selection of the computer operating system, the hiring of an executive officer to oversee the consolidated staff and a myriad of other details. All these complex steps were accomplished, and the new authority came into life as planned on July 1, 2008.

Governance

The Cape Fear Public Utility Authority is overseen by a Board of Directors consisting of five members appointed by the City and five members appointed by the County. These ten members then nominate an eleventh member acceptable to both the City and County and confirmed by both governments. The directors serve three-year staggered terms without compensation, and there is an expectation that directors will attend meetings and participate in the appropriate industry organizations.

The Board elects a Chairman, a Vice-Chairman, a Treasurer and a Secretary from the ranks of Board members. Currently, two elected City of Wilmington councilors and two elected commissioners from New Hanover County serve on the Board. The Board has the authority to set rates and fees without approval by either the City or County; the Authority has no taxing ability and must depend solely on rates and fees for its revenues. The Authority can issue revenue bonds that are not backed by the City or County.

Organization

The Authority was initially directed by an Executive Director who had five direct reports:

- Chief Engineer
- Chief Financial Officer
- Chief Operating Officer
- Chief Human Resources Officer
- General Counsel

The current organizational structure has evolved in response to identified needs. An Executive Director still leads the organization. Other key leadership positions include Deputy Executive Director for Linear Assets, Director of Treatment/Engineering, Environmental Management Director, Chief Information Officer, Public & Environmental Policy Director, Customer Service Director, HR Director and Chief Financial Officer.

Lessons Learned

Cape Fear Public Utility Authority is a Success

Over twelve years into its existence, local citizens and local officials support the regional authority and consider it an intergovernmental model of cooperation and efficiency. The new Authority is solely focused upon the safe and efficient delivery of water and sewer services, and utility decisions are not tainted by politics or other factors. Initial billing problems tested the resiliency of the Authority, its Board, its leaders and its employees. However, they endured, and the Authority is now a highly respected member of the community.

Establishment of Guiding Principles

A key lesson learned was the value of creating a framework, or guiding principles, for the establishment of a new authority. Without establishing guidelines visibly supported by local elected officials, it is doubtful that a successful authority could be formed. The following guidelines were agreed upon by local elected leaders, and they formed the bedrock upon which the Cape Fear Public Utility Authority was constructed:

1. Both the City and County would be equal partners with equal representation on the authority board.
2. Equal rates would be established for both City and County customers.
3. All City and County water and sewer assets would be transferred to the authority to serve the common good of both governments.
4. Existing City and County employees would be treated as fairly as possible. All existing employees of both systems would be offered a position. Retirement benefits would continue with the present state/local government retirement system.
5. The costs to customers for water and sewer services would not be more than if the two systems remained separate.
6. The new authority's geographic jurisdiction would consist of the City of Wilmington and the County water and sewer district. Provisions would be made for continued relations with other jurisdictions through cooperative agreements.

Involvement of Employees and Key Stakeholders

The Authority was built upon a commitment to transparency and openness. Employees were actively involved in all aspects of the development of the authority. Employees participated in adopting procedures, and interviews were held with employees to ensure a match was achieved between their skills and organizational needs. Local stakeholders were incorporated into the authority's development, and local elected officials were kept informed as the development proceeded.

Employee Compensation and Benefits

A key challenge successfully addressed was employee compensation and benefits. The City and County's compensation and benefits programs were different, and employees expressed concern that they not be penalized because of the consolidation. The action taken to address these concerns helped ensure the success of the authority. A compensation system was adopted, which established a base compensation level supplemented by performance compensation tied to quantitative metrics agreed to in advance. A cafeteria-style benefits program was adopted so employees could make decisions on where to invest their benefit dollars.

Timing for Consolidation of Separate Billing Systems

The CFPUA experience indicates that decisions regarding billing systems are perhaps the most critical and far-reaching challenge faced in establishing a new authority. Some new authorities had previously learned that initiating operations with separate billing systems and then phasing in a new consolidated billing system may reduce risks, ensure revenue flow is maintained and help provide better customer satisfaction.

The utility consolidation in Roanoke, VA was studied by City and County stakeholders, and a benchmarking visit was conducted to meet with local officials. The Roanoke team strongly advised that separate City and County billing systems should not be consolidated in the first year of the new authority’s operation. The experience of Roanoke’s officials was that the new authority would be addressing a myriad of challenges, and it should not want to also deal with a new consolidated billing system.

Despite Roanoke's advice, the decision was made that the Cape Fear Public Utility Authority would implement a new consolidated billing system at start-up. This turned out to be a problematic decision. Soon after start-up, the entire billing system crashed. The only income collected for months was from hand posted billing by the staff. When bills were issued, they were usually wrong. Some landlords were billed so late that tenants had moved before receiving a bill. Virtually everyone in the community was affected, and it took years before all of the errors were corrected.

Key Takeaways

- Transparency and a steadfast commitment to involving employees and key stakeholders are essential in forming an authority.
- The early commitment of local elected officials to a series of agreed-upon principles is essential.
- Particular attention should be given to ensure employee compensation and benefits are fairly addressed in a new authority.
- Careful consideration should be given to the method and timing by which billing systems will be addressed in a new authority.
- A new authority can be successfully formed through a thoughtful, transparent process.

Washington Suburban Sanitary Commission (WSSC Water)

Governance Model

Water and sewer commission serving two large counties (Consolidation; Special District set up as a Commission)

Background

The Washington Suburban Sanitary Commission (WSSC) was formed in May 1918. It is reported that the basis for developing WSSC was to address complaints from the District of Columbia that “streams flowing into the creating Capital were being fouled by waste from Montgomery and Prince George’s Counties.”

Recently rebranded as “WSSC Water,” the utility is a bi-county political subdivision of the State of Maryland that provides safe drinking water and wastewater treatment services for Montgomery and Prince George’s counties, except for a few cities that operate their own water facilities.

Visionary local civic leaders led the formation of WSSC Water. WSSC Water has grown to become the eighth largest utility in the United States and is one of the nation's most competent and sophisticated utilities.

Governance

With the approval of their county councils, the Montgomery and Prince George’s county executives appoint three commissioners to serve three-year terms as WSSC Water commissioners.

The duties and responsibilities of Commission members as outlined in Chapter 1.15.360 (“Commissioners’ duties”) of the WSSC Water Code of Regulations (Bylaws, Rules, and Regulations) are as follows:

a) Attend all commission meetings in person or by telephone/video when circumstances preclude in-person attendance
b) Establish WSSC Water’s mission and purpose in an annual strategic plan
c) Select a General Manager
d) Support a General Manager
e) Ensure effective organizational planning by evaluating the General Manager’s performance

f) Ensure adequate corporate resources by prudent management of the WSSC Water capital and operating budgets
g) Promote accountability of all management in an annual statement of ethical responsibility of all employees
h) Monitor legal and ethical integrity of WSSC contracting and personnel policies and their application
i) Enhance WSSC's public image
j) Accept and perform all committee assignments with professionalism

WSSC Water has established values for accountability, collaboration, environmental stewardship, excellence and innovation.

Organization

WSSC Water is led by a General Manager/Chief Executive Officer who reports to the WSSC Water Commissioners. The Office of the Inspector General (OIG) and a corporate secretary function also report directly to the Commissioners. The OIG annual report indicates they have 11 approved positions, and their FY2020 budget was $1.34 million. The Office of the Inspector General's annual report references examples where the OIG saved or recovered large sums of money through their efforts. For example, an OIG audit of Blue Plains treatment facility charges resulted in a $2.7 million reimbursement to WSSC Water.

The direct reports to the General Manager/CEO include General Counsel, Deputy General Manager of Strategy & Partnerships, Deputy General Manager of Operations and a Deputy General Manager of Administration.

WSSC Water's responsibilities go beyond those associated with most other utilities. WSSC Water has extensive regulatory authority, including policing and the development and enforcement of the plumbing code for the jurisdictions it serves.

WSSC Water has a Police Department, which is unique for a public utility. The Police Department is involved in possible terrorist threats, theft of services, illegal dumping and fraud, waste and abuse. The Police Department has jurisdiction for Montgomery and Prince George's counties and the watershed areas of Howard County.

Mission, Vision and Values

The WSSC Water Mission states: "We are entrusted by our community to provide safe and reliable water, life's most precious resource, and return clean water to our environment, all in an ethical, sustainable, and financially responsible manner."

The WSSC Water Vision is: "To be THE world-class utility, where excellent products and services are always on tap." [NOTE: WSSC Water capitalizes the word "THE" in its vision statement for emphasis.]

WSSC Water has established Values for accountability, collaboration, environmental stewardship, excellence and innovation.

Among the stated methods that WSSC Water plans to employ to achieve its Mission and Vision are the following:

- Deliver safe, reliable and consistent service
- Achieve industry-leading reliability and asset integrity
- Maintain a best-in-class operating environment safety for employees
- Improve operational efficiency and improve fixed asset utilization
- Improve financial process efficiency and fiscal sustainability
- Acquire the best people & develop and grow the team

- Communicate effectively

WSSC Water also states: "WSSC is the proud provider of safe, seamless and satisfying water services, making the essential possible every day for our neighbors in Montgomery and Prince George's counties. We work to deliver our best because it is what our customers expect and deserve".

Budget

The FY2021 WSSC Water operating and capital budget is $1.45 billion. The FY2021 budget included a 6% average rate increase. The budget sets aside $43.2 million for assistance programs to help struggling customers pay their water and sewer bills.

Lessons Learned

Vision for the Future

WSSC Water desires to be THE world class utility and serve as the worldwide benchmark for all other utilities to strive. This is a lofty and challenging goal, and care is warranted to ensure the organization remains focused on providing reliable and cost-effective services for local customers.

Organizational Structure – General Manager/CEO

By any measure, WSSC Water is a large, complex organization. It is therefore noteworthy that the General Manager/CEO has only four direct reports. Many large utilities have a multitude of staff members reporting to the top executive. This commonly results in "organizational paralysis" since these individuals typically battle for time with the top executive, which naturally affects the organization's ability to make timely decisions. Limiting the number of direct reports to the General Manager often helps him/her focus on strategic challenges and preparing the organization for long-term success.

Organizational Structure – Deputy General Managers

Based on the WSSC Water organizational chart on its website, the three Deputy General Managers have either five or six direct reports. This appears to be consistent with utility span of control best practices, not always found in other utilities.

Acting Leaders Serving in Key Leadership Positions

The WSSC Water organizational chart contained on its website shows 24 leadership positions. The chart indicates that five of the 24 leadership positions (around 20 percent) of the leaders serve in an acting capacity. Some of these leaders include the Corporate Secretary, Human Resources Director and Equal Employment Opportunities Officer. It is not known if these positions have now been filled with permanent hires. However, WSSC Water appears similar to other utilities where many key leadership positions are filled by "acting leaders."

Priority Placed Upon Investigations and Audits

WSSC Water has created and staffed an OIG to focus on conducting audits and investigations. Many utilities are interested in identifying fraud and misconduct, but they rely upon staff with other duties that lack the time and investigatory talents to conduct the types of investigations required to identify fraud and other crimes. WSSC Water's investment in the Office of the Inspector General has reportedly paid significant benefits to WSSC Water customers since the OIG group reports it recovered $2.2 million in FY2020 through its efforts.

Key Takeaways

- The organizational structure should allow the top utility executive to focus on strategic matters and long-term planning.
- Span of control guidelines should be employed throughout the organization.
- A priority should be placed on placing permanent employees in positions.
- Staffing and budget should be provided to ensure effective investigations and audits are performed.
- Independent reviews should be performed regularly.

DC Water

Governance Model

Water and sewer authority with a significant number of diverse wholesale and retail customers (Wholesale Service Purchase Arrangement; Water and Sewer Authority)

Background

The Water and Sewer Authority Establishment and Department of Public Works Reorganization Act of 1996 created the District of Columbia Water and Sewer Authority (DC WASA) as an independent authority of the District of Columbia. In 2010, DC WASA rebranded and is now known as "DC Water."

DC Water distributes drinking water and collects and treats wastewater for more than 672,000 residents in the District of Columbia. DC Water also provides wholesale wastewater treatment services for 1.6 million people in Montgomery and Prince George's counties in Maryland and Fairfax and Loudoun counties in Virginia.

Governance

DC Water is governed by a Board of Directors consisting of 11 principal members and 11 alternate members. Six Board members are District residents, appointed by the Mayor with the advice and consent of the Council. No more than four may be District employees or officials. One shall be the Director of the District Department of the Environment or a cabinet-level officer, as determined by the Mayor.

The Mayor appoints persons recommended by the other participating jurisdictions to the remaining five Board positions. Of the five non-District Board members appointed by the Mayor, one Board member shall be recommended by Fairfax County, VA, two shall be recommended by Montgomery County and two shall be recommended by Prince George's County.

All board members participate in the decisions directly affecting the management of the joint-use facilities. The District of Columbia members participate in those matters that affect District ratepayers and in setting fees for various services. DC Water may only take action on policy matters after receiving a favorable vote of no less than six members of the Board of Directors.

Organization

The organizational structure of DC Water consists of 26 departments grouped within clusters to enhance accountability and the efficiency and delivery of various services. A member of the Executive Team heads each cluster group and is accountable for their departments' service delivery and performance metrics. The Executive Vice Presidents report to the Chief Executive Officer. The cluster groups are as follows:

- Administration – Composed of the Security, Occupational Safety and Health, Office of Emergency Management, Fleet Management and Facilities departments

- Customer Experience – Composed of Customer Care, Information Technology, and Marketing and Communications
- Finance and Procurement – Composed of Finance, Rates and Revenues, Budget, the Controller, Procurement and Compliance; this cluster is led by the Chief Financial Officer and Executive Vice President
- Legal Affairs – A supporting arm to the Board of Directors, the CEO and General manager, and all DC Water clusters to minimize liability exposure and risks to DC Water
- Operations and Engineering – A consolidation of all operational and engineering functions; this includes Department of Engineering & Technical Services, Wastewater Engineering, Clean Rivers and Permit Operations; the operations departments include Sewer Operations, Water Operations, Pumping Operations, Wastewater Operations, Process Engineering, Maintenance Services and Infrastructure Management
- People and Talent – Composed of Labor Relations and Compliance, Benefits, Compensation, Talent Acquisition, Employee Development and Human Resource Information Systems
- Performance – Works with leadership to manage the Business Performance Management program; the cluster engages with cross-functional teams to discover and drive utility performance improvement under the direction of the Performance Integration and Delivery Director

Lessons Learned

DC Water Governance

- DC Water is an independent authority of the District of Columbia.
- DC Water operates or has responsibilities for activities in the District of Columbia, Maryland and Virginia. Operating over such a large geographical area, with complex economic and political challenges, is likely challenging.

DC Water Board of Directors

- By necessity, DC Water has a large Board of Directors consisting of 11 principal members and 11 alternative members. The size of the Board, and the associated voting procedures, are challenging to administer.

DC Water Organization

- By necessity, DC Water has a large, complex organizational structure. There are 26 major departments in DC Water, which likely leads to communications and coordination challenges.

Key Takeaways

- Operating retail and wholesale operations in the District and two states is challenging.
- Communications and coordination with a large Board of Directors are essential to ensure informed decisions.
- Outstanding staff is required to effectively direct the efforts of such a large water and wastewater authority.

City of Richmond & Henrico County, Virginia

Governance Model

Wholesale and retail customer relationship which evolved into the retail customer becoming an independent water supplier (Wholesale Service Purchase Arrangement; Wholesale Service Purchase Agreement)

Background

This case study focuses on the capital city region in the Commonwealth of Virginia. It chronicles the evolution and water supply issues/challenges encountered by the City of Richmond and Henrico County.

In the early days, the City of Richmond was the heart of the central Virginia economy and operated the only water and wastewater utility in the area. As it grew, Richmond invested heavily in large wastewater and water infrastructure to meet the City's growing demands. In contrast, Henrico County was sparsely developed at that time, and it lacked any significant water and wastewater infrastructure.

Like many metropolitan areas across the country, the economic opportunities and the utility needs changed significantly over time. As time passed, the City of Richmond was faced with many non-utility challenges, along with a slowing economic engine. Concurrently, Henrico County was on a different trajectory, and their utility needs were booming as its ample land became attractive for development.

Governance

The City of Richmond was a growing City, and in 1924 it constructed its first treatment plant. The City became a wholesaler of drinking water to surrounding counties. The City government had a traditional city manager and city council structure. The city council members, with the advice of the city manager, made decisions on utility budgets and the overall strategic direction of its utility.

Henrico County entered the drinking water supply picture very modestly in 1931 by allowing the establishment of sanitary districts that provided drinking water to several small geographical areas through deep wells. The County approach lacked countywide water supply planning, and the individual districts had no incentive to cooperate with each other. Henrico County has a County Manager and a board of supervisors that, with the advice of the County Manager, make decisions on utility budgets and the overall strategic direction of the utility.

The desire for greater control of its drinking water supply eventually led to Henrico proposing to construct its own drinking water treatment plant. The City, and others, vigorously opposed the construction of the Henrico plant, and the battle which commenced was locally called the "water wars."

Organization

The City of Richmond had a utility structure commonly found with large city governments in the past. Water management and strategic water supply decisions were predominately the domain of City engineers. Eventually, the City utilities function evolved to be part of the City's public works department.

The increasing importance of utility activities eventually caused the City to form a separate utility department. The City utility department is responsible for five utility functions: water, wastewater, natural gas, stormwater and electric street lighting.

For many years, Henrico County did not have a formal utility function. Water and wastewater issues were under the domain of the County engineering department. As utility matters rose on the scale of importance, Henrico created a utilities department. At present, the utilities department is responsible for water, wastewater and solid waste (recycling, curbside pick-up and drop-off locations).

The Henrico County Utilities Department reports to the Deputy County Manager of Community Operations, who reports to the County Manager. The County Manager reports to the Board of Supervisors.

Lessons Learned

Economic Growth Requires an Assured Supply of Drinking Water

In the early days, Henrico County had many higher priorities other than creating an independent drinking water supply. County leaders probably thought it was a “good deal” not to be burdened by the demands of producing drinking water, committing scarce capital to a treatment plant and enduring all the governmental interactions, inspections and permits.

But as many local governments eventually conclude, “economic development is the lifeblood of the local economy, and economic development requires water.” Business interests considering an investment in an area will always look at the availability and dependability of the water supply. In some cases, access to an adequate water supply can be a critical factor in economic development decisions.

Eventually, Henrico County became increasingly concerned when Richmond started to provide treated drinking water to fast-growing nearby Chesterfield County and Hanover County. Henrico County began to question whether the City would be capable of meeting its peak future water demands while concurrently meeting its other customers' needs. Henrico County soon decided its best course of action was to build a water treatment plant.

Explaining ever Increasing Drinking Water Costs to Citizens

Wholesale costs and customer complaints were also a key lesson from this case study. The City water treatment plant was old and subject to frequent repairs and equipment replacements. The County was increasingly suspicious that the City was unfairly shifting costs to the County, which should have been borne by City customers. Elected County officials likely tired of justifying ever-increasing water rates to their constituents while privately questioning the basis for the wholesale rates.

When Growth Projections Do Not Match

Another vital lesson was that the projected future growth of the City and County did not match. The City was on a path of modest growth mainly generated by "in fill” development and urban renewal projects. The County, in contrast, had a vast inventory of land available for exponential growth. This was a significant issue since the County was looking for a major increase in drinking water capacity, which would require a significant capital expansion of the City treatment facilities. The City was not very interested in investing scarce capital into its treatment plant, and the County believed it would be more expensive to expand the City plant than build a new County treatment plant.

The Road to Water Independence can be Rocky

When Henrico County announced its plans to build a water treatment plant, it was met with a firestorm of opposition, which was unanticipated and a key lesson from this case study.

The City of Richmond led the opposition, but it was not alone in its opposition. This “water war” resulted in a highly charged political battle that lasted for seven long years. The battle included many interested parties like regulators, legislators, environmental groups, the chamber of commerce and other stakeholders.

After seven long years, Henrico County describes the eventual resolution as follows:

“Richmond agreed to support the construction of a new treatment plant in Henrico to help protect the region’s future water needs. The Henrico water treatment plant was placed into service in 2004; Henrico will continue to purchase treated water from Richmond at a reduced volume through July 1, 2040.”

When Everything Appears Resolved, it May Not Really be Resolved

Once a settlement was reached with the City, Henrico County became a professional and highly regarded utility organization. As time passed, the County determined they needed to plan to further expand their plant to meet future growth projections.

The County and the City both draw raw water from the James River, and as regulatory analyses became more sophisticated, a new concern rose to the surface. The regulators determined that raw water withdrawals from the James River around Richmond threatened in-stream aquatic health during low flow periods. To continue operations and meet its future growth projections, Henrico County has had to commit $280 million to build a flow augmentation reservoir in a far upstream county along the James River. The reservoir will collect river water during peak flow periods and release stored water when downstream flow conditions are low.

Key Takeaways

- Long-term water supply planning must be a continuing day-to-day high-priority for all utilities.
- Localities proposing to sever the cord and build their own independent water supply should expect vigorous pushback.
- Construction costs can dramatically increase during a protracted battle over approvals.
- The increasing sophistication of regulatory analyses will be more and more important in future water supply decision-making.

City of Charlottesville and Albemarle County, Virginia

Governance Model

Regional wholesale supplier with retail City and County customers (Wholesale Service Purchase Arrangement, Collaborative Resource Development; Wholesale Service Purchase Agreement, Water and Sewer Authority)

Background

At one time, the City of Charlottesville and Albemarle County operated their own treatment and collection/distribution systems and provided safe drinking water and wastewater services within their jurisdictions. On June 7, 1972, at the prodding of Virginia regulatory agencies, the City and County agreed to form the Rivanna Water and Sewer Authority (RWSA).

Earlier in 1971, the City and Albemarle County actively sought grants from federal and state authorities to construct new water and wastewater facilities. As found in many similar situations, local governments know that control over water and wastewater services are key ingredients for economic development.

The Virginia regulatory authorities were strongly opposed to the City and County continuing to go their separate ways to build separate new treatment facilities, and they eventually became impatient with the lack of progress. The regulators finally decided to take action. The Virginia State Water Control Board advised both parties that no further grants would be approved unless they formed a regional authority.

On June 12, 1973, the City and County entered into what is known as the “Four Party Agreement.” The agreement formally established the RWSA and articulated the powers granted to the new Authority.

Governance

The City of Charlottesville utility matters are under the leadership of a Utility Director. The Director reports to the City Manager, who reports to City Council.

Albemarle County formed the Albemarle County Service Authority (ACSA) to direct water and wastewater activities. While the ACSA has its own Board of Directors, County Board of Supervisor members appoint the ACSA Board members.

The Albemarle County Service Authority is the sole public retail supplier of water and sewer services serving areas designated by the Albemarle County Board of Supervisors. The ACSA is directed by a six-member Board of Directors appointed by the Board of Supervisors to serve four-year terms. The ACSA Board appoints the ACSA Executive Director, who oversees strategic and operational activities and approves all financial decisions. Each member of the County Board of Supervisors recommends the appointment of an ACSA board member to "represent' his/her district; the appointments are affirmed by the full Board of Supervisors.

The Four Party Agreement directed that the City and County both appoint two members to the Rivanna Board of Directors. A fifth Board member was to be appointed by the City/County. Both of the City and County's utility directors were appointed to be members of the Rivanna Board. Other members were the Albemarle County Executive and the City Manager. A League of Woman Voters study commissioned in the 1990s opined that the Rivanna Board structure had the potential for conflicts of interest. The City and County Board members could approve or influence budgets or rates beneficial to their primary employers.

During a contentious debate over the expansion of the local water supply, local City and County elected officials decided that Rivanna would benefit from having City and County elected officials serving on the Rivanna Board of Directors. The current Rivanna Board of Directors is as follows:

- Albemarle County Executive
- Albemarle County Supervisor
- City of Charlottesville City Manager
- City of Charlottesville City Councilor
- City of Charlottesville Director of Utilities
- Albemarle County Service Authority Executive Director
- Appointee of City and County

Organization

The Rivanna Water and Sewer Authority is headed by an Executive Director who reports to the Rivanna Water and Sewer Authority Board of Directors. A Director of Finance and a Director of Engineering report to the Executive Director. In addition, Rivanna has water, sewer and maintenance managers, safety and communications managers, a water resources manager, an IT manager and an HR manager.

The City of Charlottesville water and wastewater activities are directed by a Director of Utilities reporting to the City Manager. The City is responsible for the distribution of drinking water and the collection of wastewater. In addition, they have a role in managing the land around the drinking water reservoirs. Like other localities, the City utilities group is responsible for the distribution of natural gas.

Water and sewer services in Albemarle County are directed by the Albemarle County Service Authority. An Executive Director heads the ACSA. Reporting to the Executive Director are an engineering director, finance director, operations manager, IT manager and the administration & HR manager.

Lessons Learned

Annexation Concerns can Adversely Affect Regional Cooperation

Until 1987, Commonwealth of Virginia law allowed cities to annex county land under the theory that the cities could best provide municipal type services "desired by the county residents." Annexation strained

the Albemarle County and City of Charlottesville relationship and made it very difficult for the governments to cooperate and form an independent water and sewer authority.

A Regional Approach can be Mandated

The Virginia regulatory authorities were strongly opposed to the City and County continuing to go their separate ways to build new treatment facilities, and they eventually became impatient with the lack of progress. The Virginia State Water Control Board eventually advised both parties that no further grants would be approved unless they formed a regional authority. The action by Virginia regulatory authorities was the sole driving force for forming the Rivanna Water and Sewer Authority.

Structure of a Regional Authority is Important

Rivanna is the product of two local governments who reluctantly sat at the table to establish a regional authority. The City and County thus retained many powers and placed the local retail utility directors on the Rivanna Board of Directors.

Key Takeaways

- The lack of trust and suspicions can complicate the establishment of a regional authority.
- Developing an agreement to form a regional authority with proper powers is challenging.
- A regional wholesale authority should be independent of its retailers, and its board members should ensure that independence is maintained.
- The board of a regional authority should be balanced and include a representative number of local elected officials and knowledgeable citizens.

Task 3
REVIEW STAFFING

TASK 3.1 REVIEW STAFFING LEVELS

SCOPE

The project team was requested to review the overall existing levels of staffing in the City and the County that are currently involved in key functional areas of water and sewer service delivery, provide observations on the overall skill levels, and identify any skill set gaps. The project team was also asked to perform a high-level review of the City's and County's human capital management processes and summarize key initiatives. Specifically, the project team was requested to perform the following scope of services for this task:

- Review and summarize the existing staffing levels, by job positions, for each functional area. The summary should include information such as the number of full-time equivalent employees (FTEs) currently designated for performing each of the functions.
- Describe, for each major function, the type of expertise and skillsets that are typically needed, the level of expertise and skills that the existing job positions have and identify any skill set and expertise gaps.
- Provide staffing benchmarking information from other comparable entities.
- Provide objective observations on the City and County staffing strengths, opportunities and constraints, and the level of skills and expertise that are needed for not only enhancing the efficiency of service delivery but also to establish a sustainable workforce for the "Utility of the Future".
- Review and summarize the overall human capital management processes and initiatives including succession planning that exist in the City and County, specific to water and sewer services delivery.
- Provide industry best practice examples of effective human capital management including succession planning, illustrated with case studies where feasible.

METHODOLOGY

A comprehensive data request was provided to Baltimore City and Baltimore County as a first step. The data was analyzed, compiled into Excel spreadsheets and used as a basis for follow-up discussions and supplemental data requests.

Since in-person interviews were not possible, the project team developed a questionnaire sent to key City and County management personnel. Also, telephone interviews and emails were utilized to better understand City and County water and sewer staffing. Benchmarking and comparisons with industry best practices were also researched.

This report's findings and best practices are based on data provided, results of the interviews, the questionnaire responses, email exchanges and benchmarking research.

Employee Questionnaire

The project team developed a questionnaire (see Appendix D) to solicit management input regarding organizational structure, staffing and human resource processes and areas for improvement. Past projects have demonstrated to the project team that input from employees is extremely valuable.

Employees were assured that the project team would treat the responses as confidential to the extent allowed by law. Employees were also informed that their responses would be aggregated in our reports to not be attributed to any individual respondents.

The questionnaire was sent to 34 management personnel (17 from the City and 17 from the County). Of the 34, the project team received six responses from the City and ten responses from the County. Each of the responses was reviewed and analyzed by the project team.

Benchmarking

The American Water Works Association (AWWA) publishes a water and wastewater utility benchmarking report each year. The latest report was published in 2019 and represents 2018 survey data from water only, wastewater only and combined water and wastewater utilities representing 38 states, two Canadian provinces and two US territories. The report includes data regarding the top quartile (most favorable, 75th percentile), median (50th percentile) and bottom quartile (least favorable, 25th percentile) of utilities across 58 key performance indicators (KPIs). Several of the findings in this report are informed by the key performance indicators from the AWWA benchmarking report.

As noted in the AWWA benchmarking report, several factors may be outside a utility's control. Factors may include water and sewer services provided, system age, topography/environment, customer base, services from support functions (finance, IT, HR, etc.), governance, political environment and subsidies from General Fund or other revenue sources. These factors should be considered when attempting to develop an apples-to-apples comparison. Additional factors that can make comparisons difficult include economies of scale (as system size increases, efficiency may improve); economies of scope (diversification of services may lead to efficiencies); and economies of density (as population density increases, unit costs may decrease).

Findings

Staffing Overview

Baltimore City

For Baltimore City, the exhibit below shows the number of positions and the respective budget for those positions (rounded to the nearest thousand) for FY 2020 and FY 2021 for each of the six services (excluding Service 676 Administration - DPW) involved with providing water and wastewater service, as provided in the FY 2021 budget.

Exhibit 3-1. City Budgeted Positions

	Positions		Budget	
Service	FY 2020	FY 2021	FY 2020	FY 2021
670 - Administration - Water/Wastewater	18	23	$1,335,000	$1,796,000
671 - Water Management	622	625	$27,971,000	$29,617,000
672 - Water and Wastewater Consumer Services	225	225	$9,625,000	$9,897,000

Exhibit 3-1. City Budgeted Positions

	Positions		Budget	
Service	FY 2020	FY 2021	FY 2020	FY 2021
673 - Wastewater Management	751	751	$35,423,000	$36,471,000
674 - Surface Water Management	130	130	$6,542,000	$7,191,000
675 - Engineering and Construction Management -WWW	176	174	$11,438,000	$11,475,000
Total	**1,922**	**1,928**	**$92,334,000**	**$96,447,000**

Below is a breakdown of the personnel budget by service.

Service 670: Administration – Water/Wastewater

The FY 2021 BOE recommended administration budget includes 23 positions, an increase of five positions over the FY 2020 budget. Of the 23 positions, 11 are water (an increase of three positions over FY 2020), and 12 are wastewater (an increase of two over FY 2020). Average personnel cost per position (budget divided by number of positions) in the FY 2021 budget is $78,100, an increase of $3,900 over the FY 2020 budget.

Service 671: Water Management

The FY 2021 BOE recommended budget for the water utility includes 625 positions, an increase of three positions over the FY 2020 budget. These new positions include an Operations Officer IV to support Human Resources and a Program Analyst and Operations Manager I to help increase compliance efforts. Average personnel cost per position in the FY 2021 budget is $47,400, an increase of $2,400 over the FY 2020 budget.

Service 672: Water and Wastewater Consumer Services

The FY 2021 BOE recommended budget includes 224 positions, remaining unchanged from FY 2020. Of the 224 positions, 224 are water (a decrease of one position), and one is wastewater (an increase of one position – a Trainer Officer). Average personnel cost per position in the FY 2021 budget is $44,000, an increase of $1,200 over the FY 2020 budget.

Service 673: Wastewater Management

The FY 2021 BOE recommended budget for the wastewater utility includes 751 positions, remaining unchanged from FY 2020. Average personnel cost per position in the FY 2021 budget is $48,600, an increase of $1,400 over the FY 2020 budget.

Service 674: Surface Water Management

In total, the FY 2021 BOE recommended budget includes 130 positions (110 stormwater, 17 wastewater and three water), which remains unchanged from the FY 2020 budget. Average personnel cost per position in the FY 2021 budget is $55,300, an increase of $5,000 over the FY 2020 budget.

Service 675: Engineering and Construction Management - Water and Wastewater

The FY 2021 BOE recommended budget includes 174 positions, a decrease of two positions over the FY 2020 budget. Of the 174 positions, 81 are water (a decrease of one position), and 93 are wastewater (a decrease of one position). Average personnel cost per position in the FY 2021 budget is $65,900, an increase of $900 over the FY 2020 budget.

Service 676: Administration – DPW

Not shown in the exhibit and not directly related to water or sewer service, DPW Administration provides leadership and support to DPW in the areas of administrative direction, human resources, fiscal management, IT, contract administration, legislative affairs, media and communications, safety and training and strategy and performance.

The FY 2021 BOE recommended budget includes 106 positions, a decrease of two positions over the FY 2020 budget. Of the 106 positions, 81 are allocated to the general fund (a decrease of 27 positions), and 25 are allocated to the wastewater utility fund (all of which are new positions).

The change in wastewater is due to the FY 2021 budget transferring the Office of Contract Administration and the Office of Safety, Training, Emergency Management and Security to the wastewater utility fund. The action includes the transfer of 25 positions and a $1.2 million reduction in credits previously associated with this service.

Average personnel cost per position in the FY 2021 budget is $75,000, an increase of $7,000 over the FY 2020 budget.

Baltimore County

For Baltimore County, the exhibit below shows the number of positions and the respective budget for those positions (rounded to the nearest thousand) for FY 2020 and FY 2021 for each of the six programs (this excludes Program 7001 General Administration) directly involved with providing water and wastewater service, as provided in the FY 2021 budget. [NOTE: This does not include the supporting departments and programs (which are not predominantly funded by Metro) mentioned in *Task 2.2 County Organizational Structure*]

Exhibit 3-2. County Budgeted Positions

	Positions		Budget	
Service	FY 2020	FY 2021	FY 2020	FY 2021
7006 - Metro Financing/Petition Proc	12	14	$751,000	$977,000
7203 - Sewer and Water Main Design	25	29	$2,127,000	$2,594,000
7801 - General Administration - Bureau of Utilities	7	16	$511,000	$1,049,000
7802 - Engineering & Regulation	15	17	$826,000	$1,033,000
7803 - Sewer/Water Operations/Maintenance	181	169	$9,487,000	$8,711,000
7804 - Pumping/ Treatment Plant Oper/Maint	108	105	$6,563,000	$6,548,000
Total	**348**	**350**	**$20,265,000**	**$20,912,000**

7001: General Administration (Office of the Director)

While not directly related to water or sewer service, DPW Administration provides management, administrative and engineering review services to all Department employees. The FY 2021 budget includes 14 full-time equivalents (eight full-time and six part-time positions), an increase of three positions over FY 2020. Average personnel cost per position in the FY 2021 budget is $95,400, a decrease of $2,800 over the FY 2020 budget.

7006: Metro Financing & Petitions

The FY 2021 budget includes 14 full-time equivalents (six full-time and eight part-time positions). This is an increase of two positions over FY 2020. Average personnel cost per position in the FY 2021 budget is $69,800, an increase of $7,200 over the FY 2020 budget.

7203: Sewer and Water Main Design

The FY 2021 budget includes 29 full-time equivalents (all full-time positions), an increase of four positions over the FY 2020 budget. Average personnel cost per position in the FY 2021 budget is $89,500, an increase of $4,400 over the FY 2020 budget.

7801 General Administration (Bureau of Utilities)

The FY 2021 budget includes 16 full-time equivalents (15 full-time and one part-time positions). This is an increase of nine positions; however, much of this was due to transfers between programs and not additional positions. Average personnel cost per position in the FY 2021 budget is $65,600, a decrease of $7,400 over the FY 2020 budget.

7802: Engineering & Regulation

The number of full-time equivalents included in the budget is 17 (16 full-time and one part-time positions). This is an increase of two over the FY 2020 budget. Average personnel cost per position in the FY 2021 budget is $60,800, an increase of $5,700 over the FY 2020 budget.

7803: Sewer/Water Operations/Maintenance

The number of full-time equivalents included in the budget is 169 (158 full-time and 11 part-time positions), representing a decrease of 12 positions over the FY 2020 budget; however, much of this was due to transfers between programs and not additional positions. Average personnel cost per position in the FY 2021 budget is $51,500, a decrease of $900 over the FY 2020 budget.

7804: Pumping/Treatment Plant Operations/Maintenance

The number of full-time equivalents included in the budget is 105 (all full-time positions), a decrease of three positions over FY 2020. Average personnel cost per position in the FY 2021 budget is $62,400, an increase of $1,600 over the FY 2020 budget.

Adequacy of Staffing

Baltimore City

Proper staffing is critical to the success of a utility organization. Supervisors were somewhat split regarding the adequacy of the current staffing level. One respondent stated that the DPW needs to fill some vacancies. Another supervisor said DPW was dealing with vacancies but was moving forward with filling several key positions. No input was offered concerning the potential impact of the current staffing level on operations or the speed by which the DPW is moving to fill key positions.

Baltimore County

An organization's success is directly tied to having the correct level of staff with the right skills. 70% of questionnaire respondents believe that the current staffing level in their unit is not adequate. This response from supervisors was one of the strongest messages delivered from supervisors in their questionnaire responses. The vast majority of supervisors believe that additional staff is needed in their units. Some supervisors pointed out concerns with the current salary scale and job titles, which they

believe adversely affect their ability to attract qualified employees. One supervisor noted that "filling positions is very difficult at Laborer II (and other levels)."

One supervisor stated that the County needs to hire qualified backup staff (or understudies) to work with knowledgeable staff and learn. It was noted that there are a considerable number of documents along with formal and informal procedures that must be understood to make sound decisions. Some in the County believe that staffing needs to be increased, given the volume of work and the need to capture important information held by individuals. A supervisor believes that backup staff is needed to better prepare for future leadership transitions, that valuable knowledge has already exited the county government and that the current knowledge capture effort is weak or absent.

These insights are further supported in the remainder of this report.

Benchmarking

Customer Accounts per Employee

This performance indicator is a general measure of employee efficiency. Typically, the higher this ratio, the more efficient a utility's employees are considered to be. The indicator is calculated as follows:

$$\text{Customer accounts per employee} = \frac{\text{number of accounts}}{\text{total number of positions}}$$

The three exhibits below show FY 2020 customer accounts per employee for water, wastewater and combined water and wastewater, respectively. It was reported that the number of active accounts in the City is 192,500 for each water and sewer. In the County, it was reported that there are 206,600 water and 236,400 sewer active accounts. The City provides the full spectrum of water (treatment and distribution) and wastewater (treatment and collection) services, while the County only provides wastewater collection service. While the County assists the City with water repairs and maintains some small wastewater treatment package plants, it provides nowhere near the full range of services the City does. For this reason, in an attempt to provide an apples-to-apples comparison between the City and County, the County has been excluded from the water only exhibit, and only wastewater distribution (not treatment) is included in the wastewater only exhibit. In addition, the number of County accounts has been added to the number of City accounts in each exhibit for the City since the City provides service to both the City and County. The number of employees within each service was estimated based on the organizational charts and the position counts provided in the FY 2020 budget.

Exhibit 3-3. Water Customer Accounts per Employee (FY 2020)

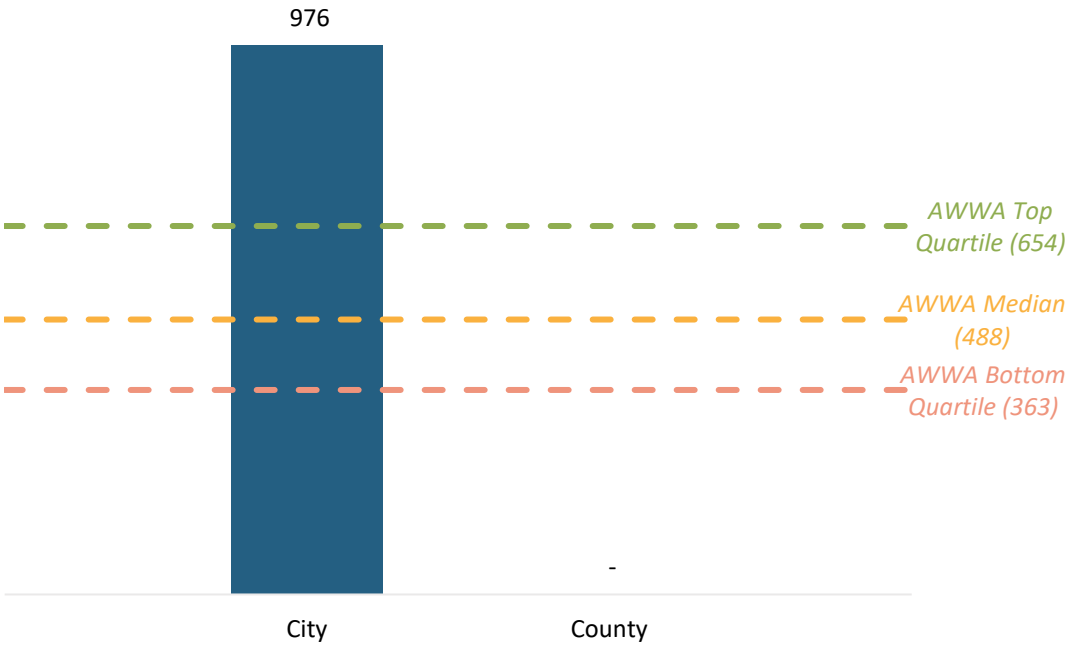


Exhibit 3-4. Wastewater Customer Accounts per Employee (FY 2020)

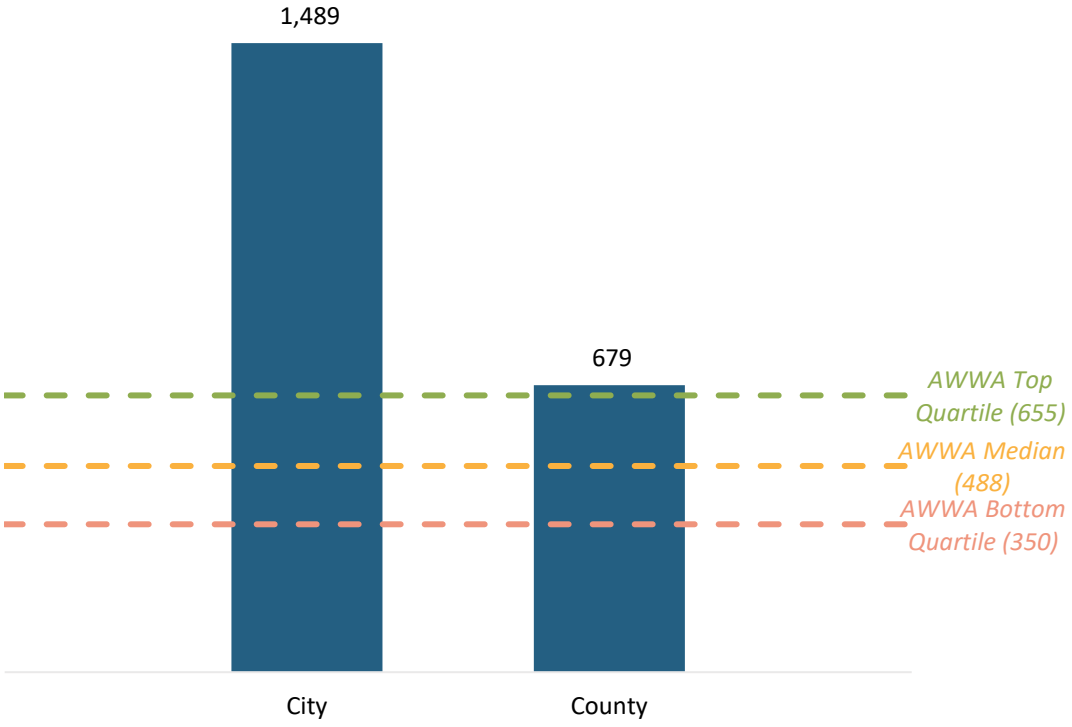
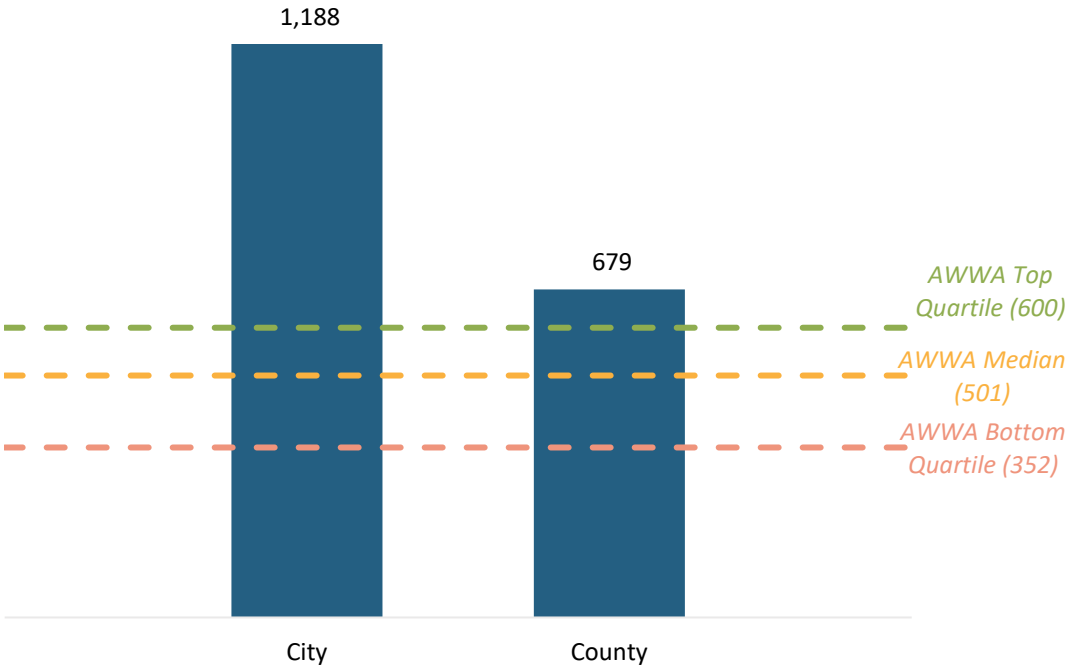


Exhibit 3-5. Combined Water and Wastewater Customer Accounts per Employee (FY 2020)



Based solely on the numbers in the three exhibits, the City has a customer accounts per employee ratio within the top quartile for all three performance indicators. According to the exhibits, the County is also within the top quartile (wastewater and combined exhibits). Looking purely at the ratios in the three exhibits above would lead one to think the City and County are highly efficient, given the number of customer accounts per employee. That may certainly be true; however, they may also be understaffed, or it may be a combination of the two. As previously stated, various factors outside the control of the City and County may affect an equitable comparison, such as the following:

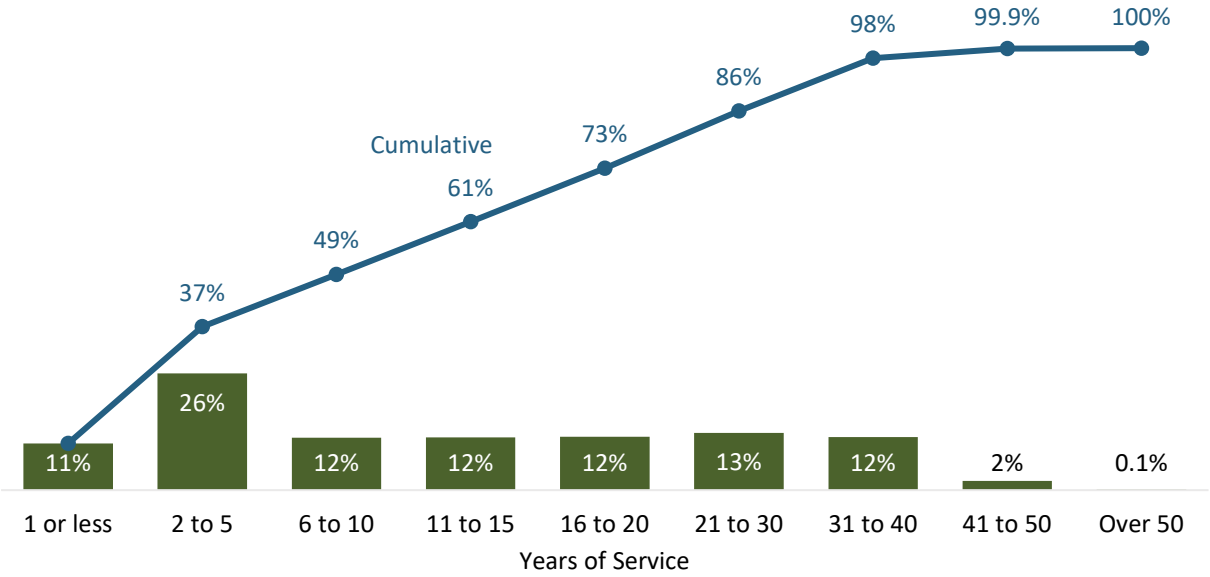
- The City provides all four major services (water treatment and distribution and wastewater treatment and collection). For the most part, the County provides only wastewater collection (this was attempted to be accounted for in the exhibits).
- Since the City provides all four major services, overhead personnel was split between the services for the City, whereas all County overhead was allocated solely to wastewater collection (even if a small portion should be allocated to what water treatment and distribution and wastewater treatment services are provided by the County).
- The County is less densely populated given its size and may need more employees to maintain the miles of mains within the sewer collection system.

Years of Service

Baltimore City

The exhibit below charts percentage of City DPW employees by number of years of service (by range of years and cumulatively). The data is based on the number of years from an employee's in-service date to December 31, 2020 (assumed to be "current day"). The dataset consists of 2,235 DPW employees (not solely water and sewer employees, as positions in the dataset could not be grouped by service).

Exhibit 3-6. City Years of Service



As shown in the exhibit, 11% of DPW employees have worked for the City for a year or less, and 37% of DPW employees have less than five years of service with the City. Conversely, 27% of employees have worked for the City for more than 20 years.

The data provided by the City on years of service also included information on age. This data indicates that as of December 31, 2020, 10% of DPW employees are aged 65 years or older. Below are employees 80 years or older listed within the data provided:

- Laborer aged 91 with 52 years of service
- Laboratory Technical Supervisor aged 87 with 50 years of service
- Chemist III aged 84 with 41 years of service
- Utilities Installer and Repairer III aged 81 with 22 years of service
- CDL Driver I aged 80 with 54 years of service

While some of these employees may have already retired, we have no reason to assume that is the case as the data provided is considered to be active workforce.

Age certainly should not be a factor in determining eligibility to work; however, it is a direct indicator of the aging workforce in the DPW (both in the City and throughout governments across the nation).

The City will be pressed to find qualified new employees to replace the current experienced and knowledgeable staff. Many of the 10% of employees that are 65 years or older are responsible for the "blocking and tackling" that is essential to keeping the water and sewer system operating. Many of these employees have intimate knowledge of the collection system, pump stations and distribution system.

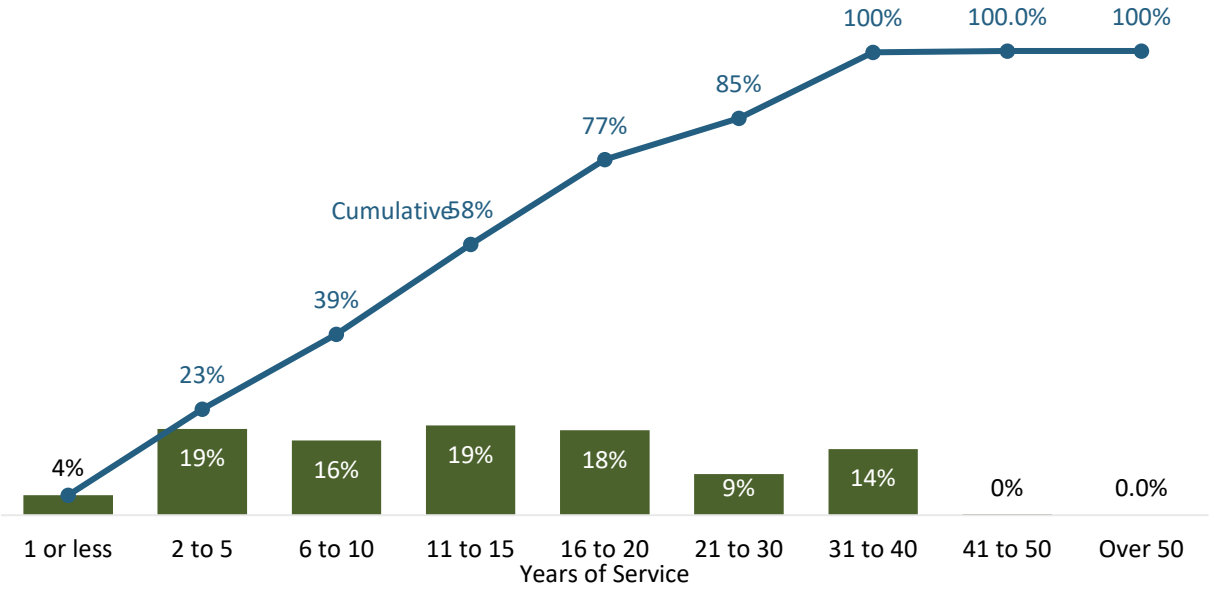
The loss of this knowledge and hiring qualified replacements will likely be a challenge for the City. This challenge is ably illustrated by the fact that only 3% of current DPW employees are 25 years or younger. The data demonstrates the need for the City to implement a sound recruitment plan and knowledge capture program.

Baltimore County

The exhibit below charts percentage of County employees by number of years of service (by range of years and cumulatively). Similar to the City data, this data is based on the number of years from an employee's

in-service date to December 31, 2020. The dataset consists of 372 employees within the Bureau of Engineering & Construction, the Bureau of Utilities and the Metropolitan District Financing and Petitions Office (Metro) in the Department of Public Works.

Exhibit 3-7. County Years of Service



As shown in the exhibit, 4% of DPW employees have worked for the County for a year or less, while 23% of DPW employees have less than five years of service with the County. Conversely, 23% of employees have worked for the County for more than 20 years.

Like the City data, the County's data on years of service also included information on age. This data indicates that as of December 31, 2020, 6% of DPW employees are aged 65 years or older. DPW does not have any employees 80 years or older; the oldest employee listed is an Engineer III aged 74 with 24 years of service. Like the City, the challenge of hiring qualified replacements for this aging workforce is compounded by the fact that only 3% of current DPW employees are 25 years or younger, demonstrating a need for the County to implement a sound recruitment plan along with a knowledge capture program.

Baltimore City and County Comparison

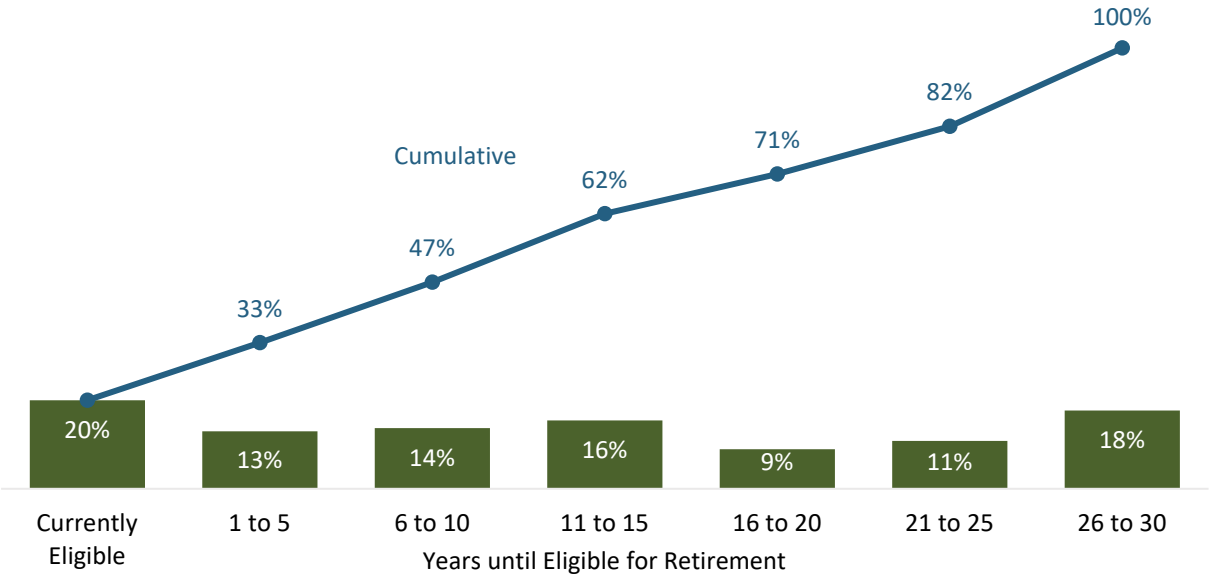
Based on the City and County years of service data, a greater percentage of the City's workforce has a short tenure (five years or less) than the County's workforce (10% vs. 4%). The City also has a slightly more significant percentage of its workforce (27% vs. 23%) with more than 20 years of service. However, for the most part, the makeup of workforce tenure at the City and County is similar: the cumulative years of service ranging from "11 to 15" years to "Over 50" years differ by no more than four percentage points.

Retirement Eligibility

Baltimore City

The exhibit below charts the percentage of City DPW employees by number of years until being eligible for retirement. The exhibit uses the same dataset of 2,235 DPW employees as the Years of Service exhibit above, assuming that employees are eligible for retirement after 30 years of "normal service" or at the age of 65 (with five years of service).

Exhibit 3-8. City Years until Eligible for Retirement

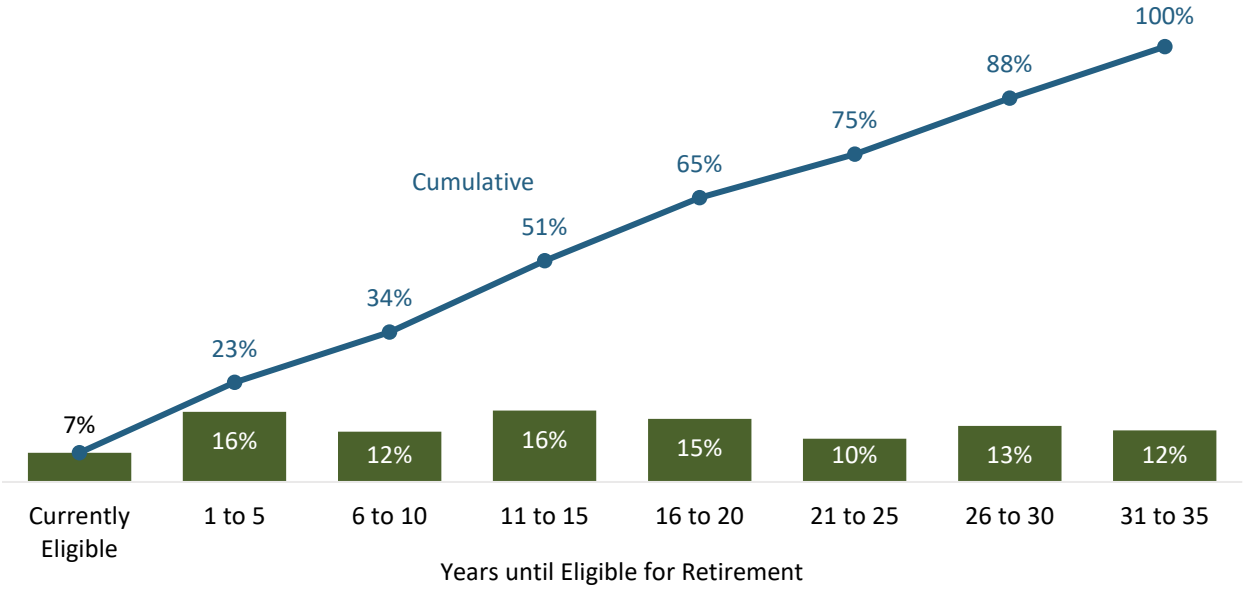


As shown in the exhibit, 20% of DPW employees are currently eligible for retirement, while 47% of the workforce will be eligible for retirement in ten years or less.

Baltimore County

The exhibit below charts the percentage of County DPW employees by number of years until being eligible for retirement. The exhibit uses the same dataset of 538 DPW employees as the Years of Service exhibit above, assuming that employees are eligible for retirement after 35 years of "creditable service" or at the age of 67 (with ten years of service).

Exhibit 3-9. County Years until Eligible for Retirement



As shown in the exhibit, 7% of DPW employees are currently eligible for retirement, while 34% of the workforce will be eligible for retirement in ten years or less.

Baltimore City and County Comparison

Based on the City and County retirement eligibility data, a greater percentage of the City's workforce is currently eligible to retire than the County's workforce (20% vs. 7%). The City also has a slightly more significant percentage of its workforce eligible to retire in ten years (47% vs. 34%). Overall, the City has a greater share of its workforce eligible for retirement. This is due to an older workforce in the City and the more generous retirement eligibility requirements (30 years of service or age 65 plus five years of service in the City vs. 35 years of service or age 67 with ten years of service).

Benchmarking

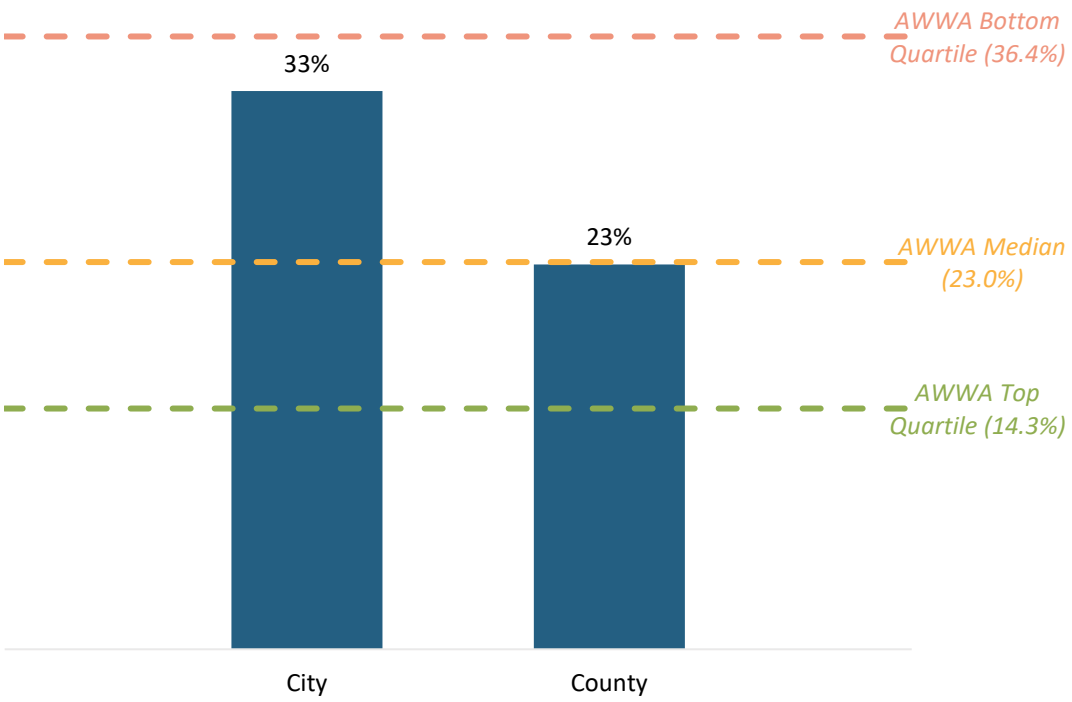
Retirement Eligibility within Next Five Years

This service delivery indicator is a snapshot measure of the number of employees within the Department eligible for retirement within the next five years. This metric provides managers with an indication of potential turnover and can aid in succession planning. It is calculated as follows:

$$\text{retirement eligibility (\%)} = \frac{\text{employees eligible for retirement in the next five years}}{\text{total number of positions}}$$

The exhibit below shows the percentage of City and County DPW employees eligible to retire in the next five years, along with the AWWA benchmarks.

Exhibit 3-10. Percentage of Employees Eligible to Retire within Next Five Years



As shown in the exhibit, the percentage of employees eligible to retire within the next five years in the City is higher than in the County. Comparing the data for the City and County with that of the AWWA

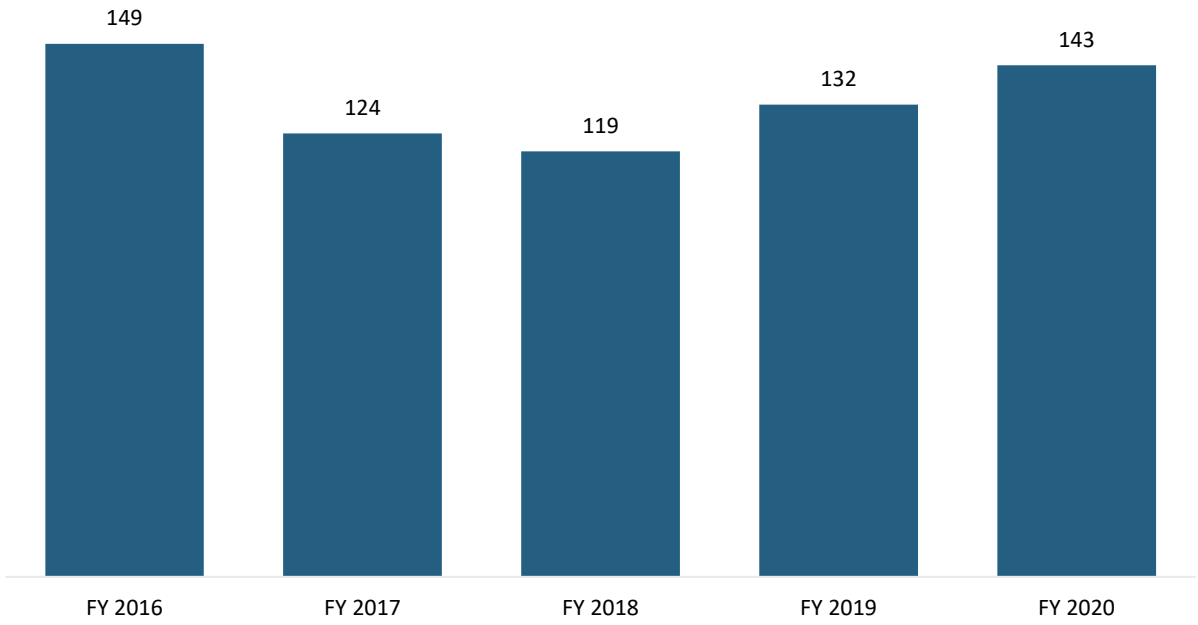
benchmarking participants, the City is between the bottom quartile and the median (putting the City within the bottom 50th percentile) while the County is between the median and the top quartile (putting the County within the top 50th percentile).

Employee Turnover

Baltimore City

Baltimore City provided extensive data concerning DPW employee turnover (the term used by the City for employee departures in the data provided was "terminations"). In this report, employee turnover includes any type of employee departure (voluntary or involuntary). The exhibit below shows turnover within the Bureau of Water and Wastewater in Public Works by fiscal year from FY 2016 through FY 2020. The data indicates that 667 employees from the Bureau left City employment during these five years. The breakdown of the data by year is as follows:

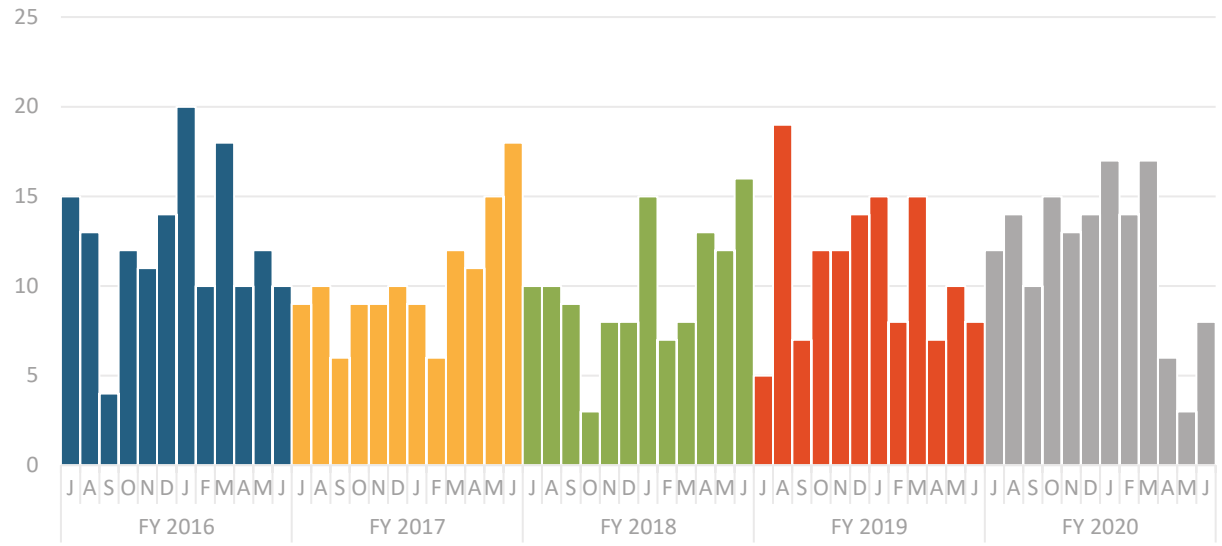
Exhibit 3-11. City Water and Wastewater Bureau Turnover by Fiscal Year



As can be calculated from the exhibit from 2016 through FY 2020, the Bureau of Water and Wastewater averaged 133 departures per year. In this timeframe, turnover was highest in FY 2016, with it tapering off through FY 2018 and then picking back up again through FY 2020.

The following exhibit further breaks down the turnover data by month for the five fiscal years from FY 2016 through FY 2020.

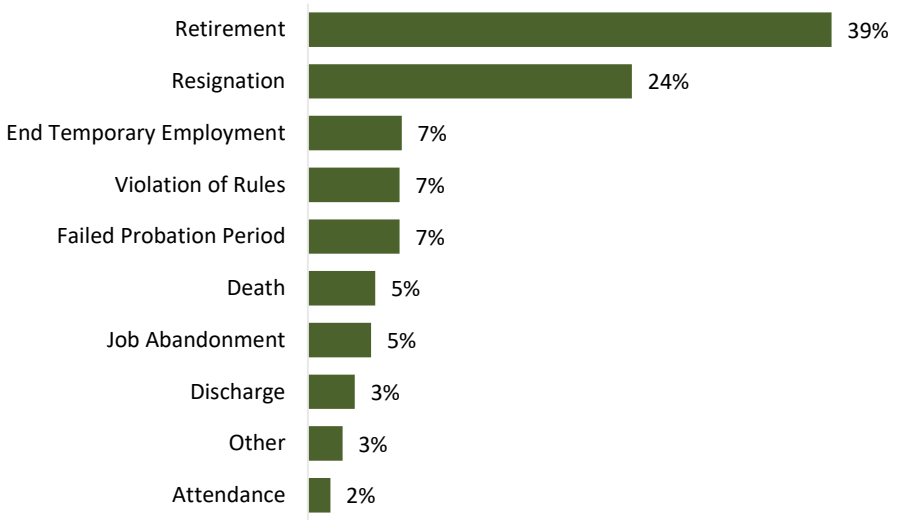
Exhibit 3-12. City Water and Wastewater Bureau Turnover by Fiscal Year and Month



As can be calculated from the exhibit from 2016 through FY 2020, the Bureau of Water and Wastewater averaged 11 departures per month. January of FY 2016 had the most turnover (20 departures), followed by August of FY 2019 (19 departures) and March of FY 2016 (18 departures). Months with the least turnover consisted of October of 2018 and May of FY 2020, each with three departures.

The exhibit below shows the percentage of the combined 667 BWW employee departures from FY 2016 through FY 2020 by reason for turnover.

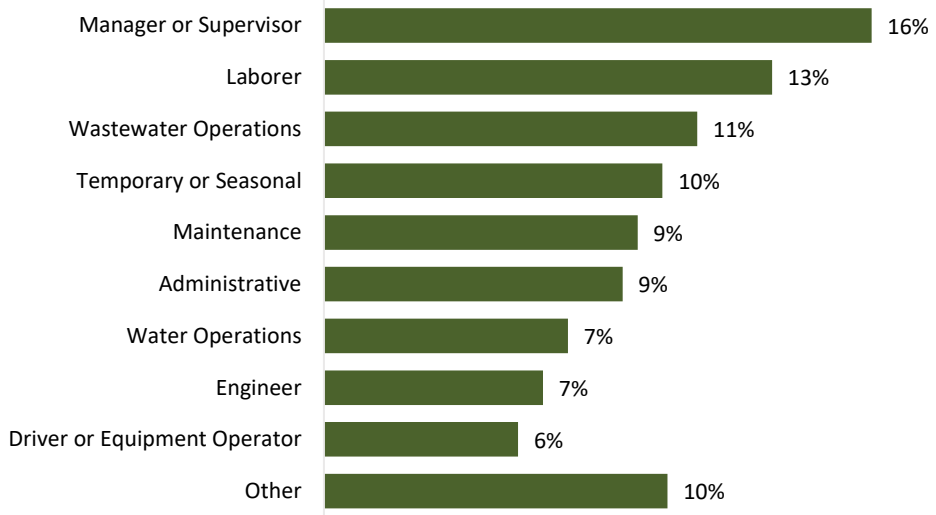
Exhibit 3-13. City Water and Wastewater Bureau Turnover by Reason



As shown from the exhibit, the highest percentage of turnover was due to retirement, followed by resignations. Other turnover reasons included the ending of temporary employment, violation of rules, failed probation period, death, job abandonment, discharge and attendance. “Other” reasons include unsatisfactory performance, health reasons, misconduct and disability.

The exhibit below shows the percentage of the combined 667 BWW employee departures from FY 2016 through FY 2020 by position:

Exhibit 3-14. City Water and Wastewater Bureau Turnover by Position



It is not surprising that laborers experience a high turnover rate for water and wastewater employees since laborers are entry-level positions, and new hires may conclude that water/wastewater work is not attractive to them. Of the laborers, 39% either violated rules, failed probation, abandoned the job, were fired or violated attendance policies. Another 31% retired, 16% resigned, and the remaining 14% departed the workforce for some other reason.

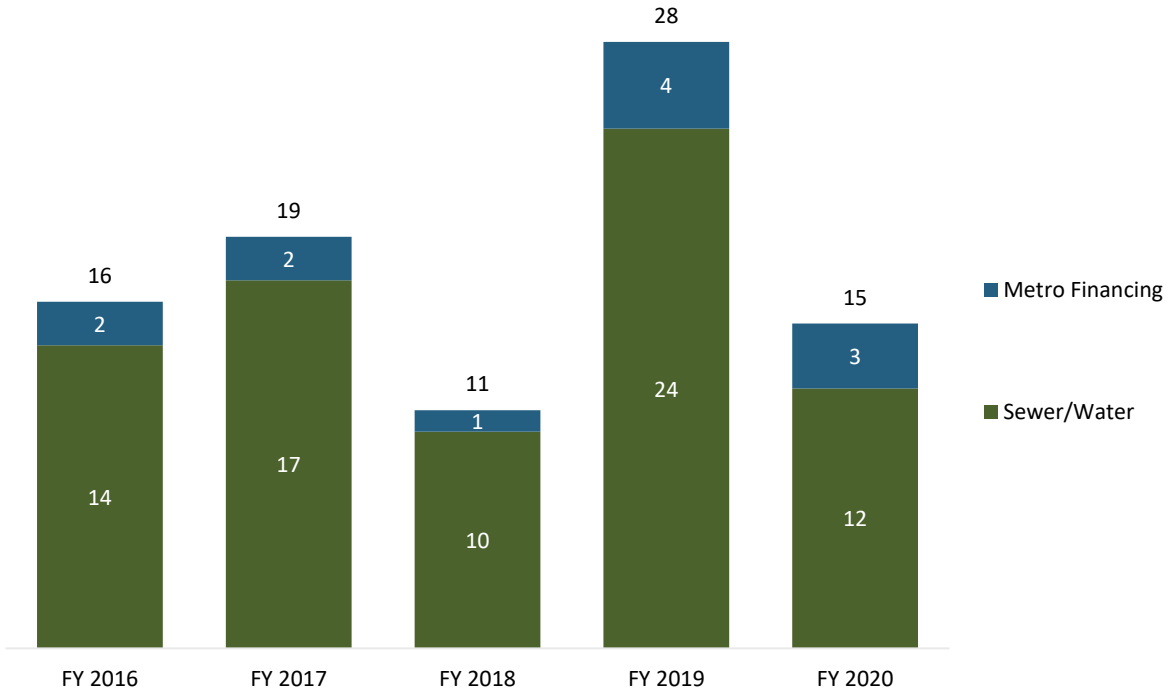
It is not surprising to see turnover in temporary or seasonal employees since, by definition, they are just temporary or seasonal workers.

However, the managerial or supervisory (including chiefs and superintendents) turnover is higher than expected. Two-thirds of these employees retired, 17% resigned, and the remaining 16% departed the workforce for some other reason.

Baltimore County

Baltimore County, like the City, provided data concerning DPW employee turnover. The data is broken down by unit as opposed to Bureau. The exhibit below shows employee departures within the following County DPW units by fiscal year from FY 2016 through FY 2020: Sewer/Water Operations and Metro Financing. The data indicates that 89 employees from these two organizational units left County employment during this timeframe. The breakdown of the data is as follows:

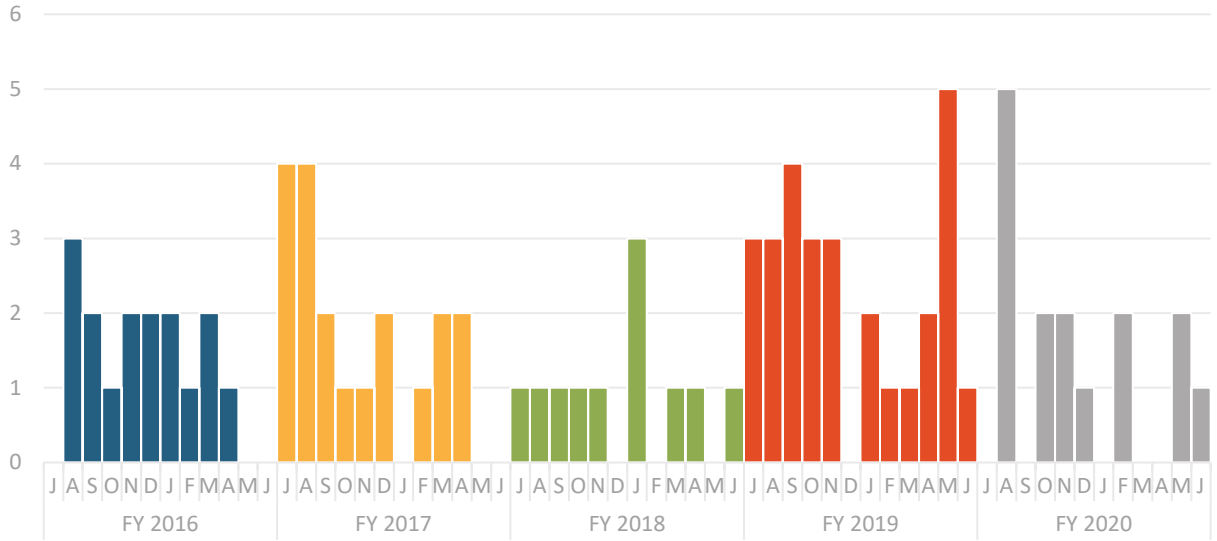
Exhibit 3-15. County Water and Wastewater Turnover by Unit and Fiscal Year



As can be calculated from the exhibit from 2016 through FY 2020, Metro Financing averaged 2.4 employee departures per year, while Sewer/Water averaged just over 15. Combined, the two organizational units averaged just under 18 departures per year. Of the five years, FY 2019 had the most turnover, while FY 2018 had the least.

The following exhibit further breaks down the turnover data by month for the five fiscal years from FY 2016 through FY 2020.

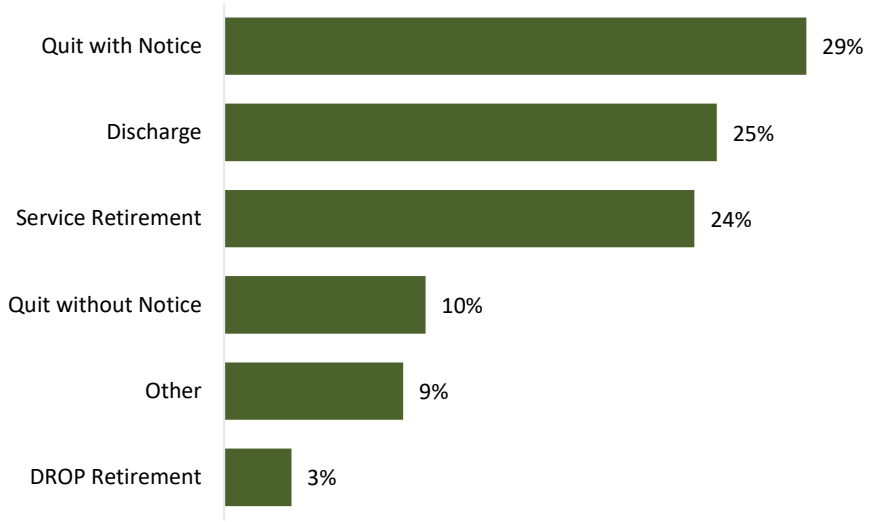
Exhibit 3-16. County Water and Wastewater Turnover by Fiscal Year and Month



As can be calculated from the exhibit from 2016 through FY 2020, the two organizational units averaged one departure per month. May of FY 2019 and August of FY 2020 had the most turnover (five departures). Several months had no turnover.

The exhibit below shows the percentage of the combined 89 Sewer/Water Operations and Metro Financing departures from FY 2016 through FY 2020 by reason for turnover.

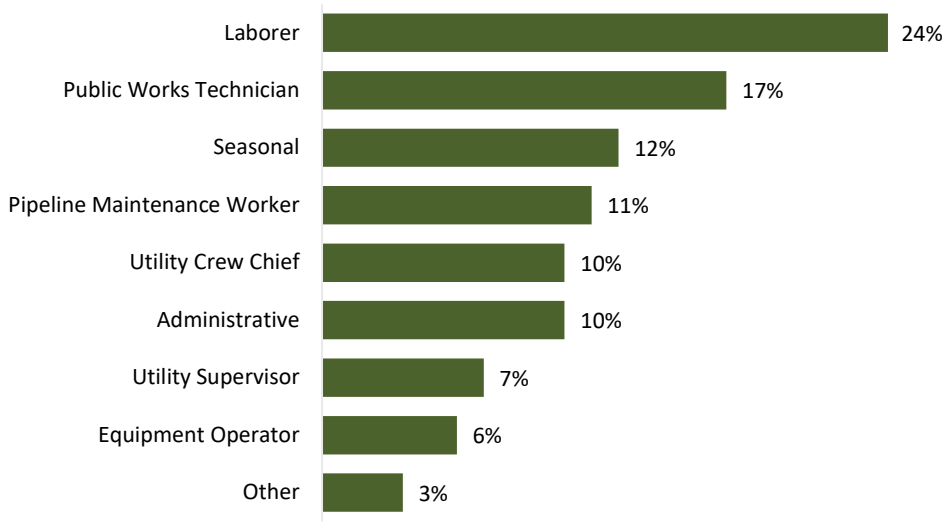
Exhibit 3-17. County Water and Wastewater Turnover by Reason



As shown from the exhibit, the highest percentage of departures was due to quitting with notice, followed by discharge (typically equated to being "fired") and service retirement. Other turnover reasons included quitting without notice and DROP (deferred retirement option program) retirement. "Other" reasons include disability, not returning after leave of absence and probationary.

The exhibit below shows the percentage of the combined 89 Sewer/Water Operations and Metro Financing departures from FY 2016 through FY 2020 by position:

Exhibit 3-18. County Water and Wastewater Turnover by Position



Like with the City data, it is not surprising that laborers experience a high turnover rate for water and wastewater employees. Of the laborers, the breakdown of turnover reason was 25% discharged (i.e., fired), 25% quit with notice, 25% quit without notice and 25% retired.

It is also not surprising to see turnover in seasonal employees since, by definition, they are seasonal workers.

However, the Utility Crew Chief and Utility Supervisor positions accounted for 17% of the turnover, which is higher than expected. About 75% of these employees retired while the remaining 25% quit with notice.

Baltimore City and County Comparison

While there are likely differences in how the City and County track data and the terminology used in the termination/turnover reports provided, comparing DPW turnover data for the City and County results in the following findings:

- Retirement is the most common source of turnover in the City, while it is the third most common in the County.
- Quitting (with notice) is the most common source of turnover in the County, while it is the second most common in the City (referred to as "resignation" in the City).
- The percentage of employees discharged is significantly higher for the County than the City. While employees within the City may also have been "discharged," the term was not commonly used as a reason for termination.
- It certainly makes sense that the City has more turnover than the County, given that the City has more employees. In the next section, we calculate turnover as a percentage of total workforce, which helps put the City/County comparison on an apples-to-apples basis.

Benchmarking

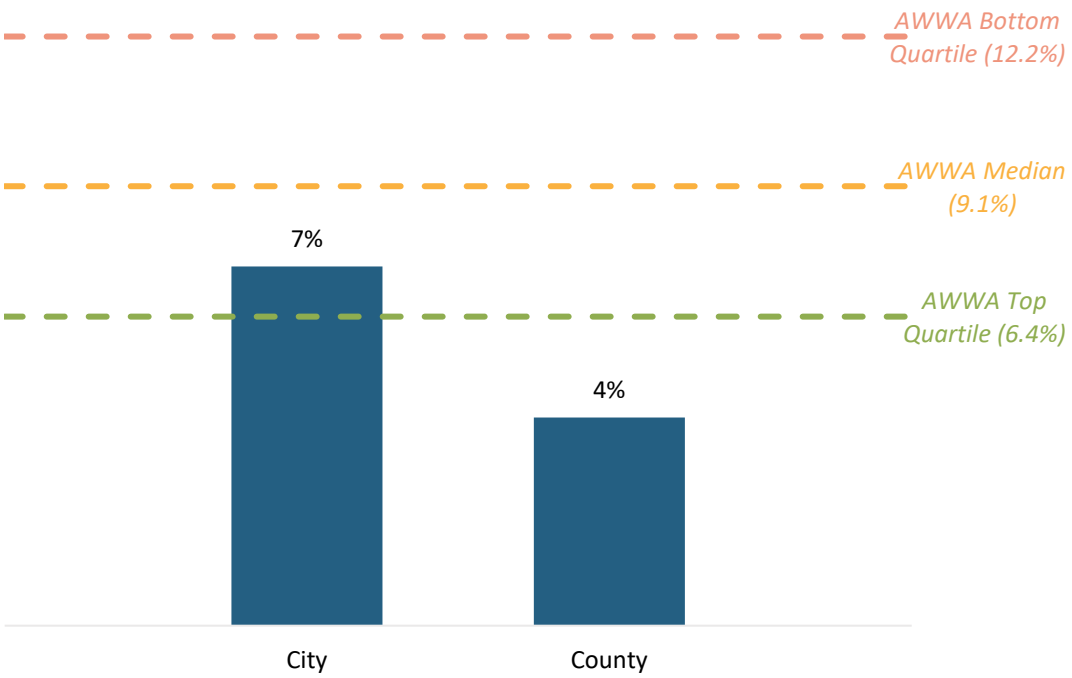
Employee Turnover

This service delivery indicator is a snapshot measure of the number of employee departures within the DPWs of the City and County at any given time. Critical staffing shortages were identified by senior managers within the City and County departments, so tracking departures, particularly within critical operational areas, would indicate progress being made to improve recruitment and retention. The indicator is calculated as follows:

$$\text{employee turnover (\%)} = \frac{\text{number of employee departures}}{\text{total number of positions}}$$

The exhibit below shows FY 2020 employee turnover for the DPW of each the City and County along with the AWWA benchmarks.

Exhibit 3-19. Employee Turnover (FY 2020)



As shown in the exhibit, water/wastewater employee turnover (employee departures as a percentage of total positions) for the City is slightly higher than for the County. Comparing the FY 2020 data for the City and County with that of the AWWA benchmarking participants, the City is between the median and top quartile (putting the City within the top 50th percentile) while the County is within the top quartile (25th percentile).

Employee Vacancies

Baltimore City

City DPW management provided vacancy information for the Bureau of Water and Wastewater (Administration, Utility Maintenance, Water Facilities, Wastewater Facilities, Engineering and Construction and Asset Management).

Baltimore County

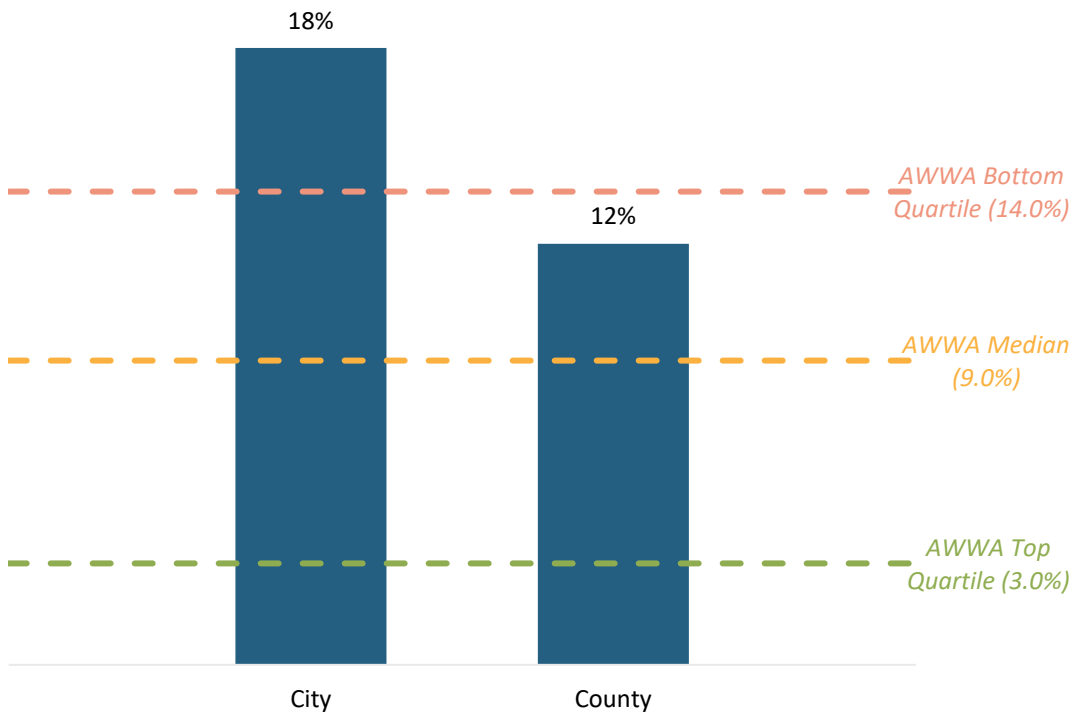
County DPW management provided vacancy information for the Bureau of Utilities (Administration, Pipeline Maintenance, Construction and Repair, Pumping and Treatment and Engineering and Regulation).

Benchmarking

Employee Vacancies

$$\text{vacancies (\%)} = \frac{\text{number of vacancies}}{\text{total number of positions}}$$

Exhibit 3-20. Employee Vacancy Rate (FY 2020)



As shown in the exhibit, the vacancy rate for water and wastewater employees for the City is higher than in the County. Comparing the FY 2020 data for the City and County with that of the AWWA benchmarking participants, the City is in the bottom quartile, while the County is between the bottom quartile and median (putting the County within the bottom 50th percentile). The vacancy rates for both the City and County are unfavorable and support the need for effective workforce succession planning.

Key DPW Leadership Turnover

Baltimore City

The exhibit below provides a summary of some of the key employee departures (for only retirement or resignation) from January 2015 (seventh month of FY 2015) through October 2020 (fourth month of FY 2021) for Water and Wastewater Bureau and those within DPW Administration. It should be noted this data does not reflect any employee departures after October 2020.

Exhibit 3-21. Key City WWB and DPW Leadership Turnover

Fiscal Year	Position	Reason	Years of Service
2016	Chief of Utility Finances	Retirement	26
2016	Engineer Supervisor	Retirement	32
2016	Operations Manager I	Resignation	6
2016	Operations Manager I	Resignation	2
2016	Water Systems Pumping Manager	Retirement	30
2017	Chief of Fiscal Services I	Retirement	44
2017	Engineer Supervisor	Retirement	6
2017	General Counsel	Resignation	5
2017	Operations Manager I	Retirement	35
2017	Operations Manager III	Resignation	26
2017	WWW Chief of Engineering	Resignation	0.2
2017	WWW Chief of Engineering	Resignation	5
2017	WWW Division Manager I	Resignation	1
2017	WWW Division Manager II	Resignation	3
2018	Engineer Supervisor	Resignation	4
2018	Operations Officer IV	Retirement	38
2018	Operations Officer V	Resignation	11
2019	Energy Program Manager II	Retirement	4
2019	Engineer Supervisor	Resignation	5
2019	Operations Director II	Retirement	31
2019	Operations Manager I	Resignation	10
2019	Operations Manager I	Resignation	2
2019	Operations Officer IV	Resignation	2
2019	Operations Officer V	Retirement	5
2019	WWW Division Manager II	Retirement	6
2020	Agency IT Supv/Project Manager	Retirement	31
2020	Director of Public Works	Retirement	9
2020	WW Plant Manager	Retirement	49
2020	WWW Chief of Engineering	Resignation	2
2021	Assistant Counsel	Resignation	2
2021	Operations Director II	Resignation	3

As shown in the exhibit, the Director of Public Works retired from the City in FY 2020. The General Counsel resigned in FY 2017, and the Assistant Counsel resigned in FY 2021. The Chief of Utility Finances retired in FY 2016, while the Chief of Fiscal Services retired in FY 2017.

Since FY 2017, the W/WW Chief of Engineering position has resigned three times: after five years of service in FY 2017, followed by only two months of service in FY 2017 and then two years of service in FY 2020.

The 14 retirements in the exhibit represent a loss of 346 years of service, averaging 25 years of service at retirement (ranging from four to 49 years of service at retirement).

The exhibit also indicates that many senior leaders have left City employment (after retiring or resigning) after short tenures. The summary shows that 35% of the senior leaders exited City employment with just five years of service or less.

Baltimore County

The exhibit below provides a summary of some of the key employee departures (for only retirement or resignation) from January 2015 (seventh month of FY 2015) through August 2020 (second month of FY 2021) for Sewer/Water Operations, Metro Financing and DPW Administration. It should be noted this data does not reflect any employee departures after August 2020.

Exhibit 3-22. Key County W/S and DPW Leadership Turnover

Fiscal Year	Position	Reason
2015	Utility Supervisor II	Service Retirement
2016	Chief of Design	DROP Retirement
2016	Utility Crew Chief	Service Retirement
2016	Utility Superintendent	DROP Retirement
2017	Management Analyst III	DROP Retirement
2017	Utility Crew Chief	Service Retirement
2017	Utility Supervisor I	Service Retirement
2017	Utility Supervisor I	Service Retirement
2018	Utility Crew Chief	DROP Retirement
2018	Utility Crew Chief	Quit with Notice
2018	Utility Crew Chief	Service Retirement
2018	Utility Supervisor I	DROP Retirement
2019	Utility Crew Chief	Quit with Notice
2019	Utility Crew Chief	Quit with Notice
2019	Utility Crew Chief	Service Retirement
2019	Utility Supervisor I	Service Retirement
2020	Utility Supervisor I	Service Retirement

As shown in the exhibit, the Chief of Design retired from the County in FY 2016. Since FY 2016, five Utility Crew Chiefs retired, and three quit with notice. Since FY 2015, six Utility Supervisors have also retired.

Recruitment of Director of Public Works

Baltimore City

The Director of Public Works retired in February 2020, after six years as Director and nine years with the Department. The City has posted a job advertisement for a Director of Public Works. The job advertisement is very detailed and professional. It is not clear how the recruitment of the DPW Director is proceeding or the timetable for a permanent Director's appointment.

Baltimore County

The Director of Public Works retired in May 2020, after leading the Department for four years and having worked for the County for 30 years. At that time, the County initiated a search for a new director. Like the City, the County is currently advertising for a permanent DPW Director. The job advertisement is well written and accurately describes the position. Unlike job specifications for other County water and sewer positions, the ad describes the importance of coordinating with the City. The job advertisement states the Director "Undertakes executive level coordination with Baltimore City on regional water infrastructure planning, funding, maintenance, billing, and compliance with agreements."

County management has contacted trade groups and hiring firms but has not had much luck in finding viable candidates. Finding someone with water, solid waste and transportation experience makes the search even more difficult.

It was reported that, due to the lack of City and County DPW Directors, there is a sense of "operational paralysis," and no one wants to make any decisions until the City and County Director positions are permanently filled.

Acting Senior Leadership Positions

Baltimore City

City DPW has some employees serving in an "acting" capacity in senior leadership positions. Some of these employees have been operating in an acting capacity for some time, and the City website does not indicate they are actively recruiting to permanently fill these key positions. Appointing interim leaders for short periods of time is sometimes necessary, but this can create uncertainty and instability in the organization over time.

When the Director of Public Works retired in February 2020, the Deputy Director was named the Acting Director of Public Works. Others serving in acting capacities include the Head of the Water and Wastewater Bureau, the Head of the Engineering & Construction Office and the Head of the Office of Asset Management. In addition, two significant positions were removed in the past few months. The Utility Manager position was removed so that the Customer Service & Support Division reports directly to the Director of Public Works. The Chief of Staff position was removed, and offices and divisions reporting to that position were reassigned to report to either the Chief of Administration or the Head of the Bureau of Water and Wastewater.

Baltimore County

County DPW also has some key employees serving in an "acting" capacity. When the Director of Public Works retired in May 2020, the County then named the Chief of the Bureau of Engineering & Construction as the Acting Director of Public Works. The Acting Director then retired in October 2020, and the County named the Deputy Director for Transportation as Acting Director of Public Works.

Key Employee Succession Planning

The work of water and wastewater utilities is complex and requires significant expertise and experience. Progressive water and wastewater utilities have found that it is essential to implement a sound succession planning process to ensure new leaders are ready to step into key leadership positions.

Many employees within the water and sewer utility industry started their careers in the 1970s or 1980s, a few years after the Clean Water Act was passed. These employees have gained valuable experience as they grew with the utility industry over their careers.

As shown in prior exhibits, the City and County have several older, experienced employees, many of whom are either already eligible for retirement or will be over the next several years.

Water and wastewater utilities across the United States are having difficulty finding an adequate supply of licensed operators. This operator shortage is projected to be more severe in the years ahead.

It appears that the City and County have not adequately prepared for the recent retirements or the potential retirements which are likely to occur in the next four to five years. Proactive utilities have recognized the need to ensure the availability of new operators by establishing operator apprentice programs or by working proactively with local educational institutions to ensure new operators and mechanics are in the replacement pipeline.

As is the case with most utilities, the "best" (high potential) employees are the ones that frequently leave. This can be costly for utilities since the investment in employee training is lost when the employee leaves and the "learning curve" costs must be incurred again when a new employee is hired.

Baltimore City

The City's retirement eligibility and turnover data indicate a need for a better succession planning process. Within the next ten years, almost half of the DPW workforce will be eligible for retirement. Over the past several years, key positions have left the workforce representing hundreds of years of experience. The data indicates that the City has not been able to develop internal talent for key leadership positions. Instead, the City has been forced to hire senior-level employees from outside the DPW with mixed results. Since the retirement of the Director of Public Works in February 2020, the City has been searching for a permanent Director of Public Works. In the past few months, the Utility Manager position that headed the Customer Service & Support Division (and had a vast knowledge of the City/County billing processes) and the Chief of Staff position (which had several DPW offices reporting to it) were removed.

Baltimore County

Like the City, the County's retirement eligibility and turnover data indicate a need for a better succession planning process. Over a third of the County DPW workforce will be eligible for retirement over the next ten years. Key positions have retired or resigned over the past several years. Since the Director of Public Works retired in May 2020, the County has been searching for a permanent Director. The acting Director also retired in October 2020. In addition, other key positions with years of knowledge on engineering and budgetary aspects within Public Works will be eligible to retire in the next few years.

The City and County need to prepare now for the significant loss of experienced employees in the next few years by having experienced employees train and mentor new hires.

At some point in the near future, a great deal of knowledge about plants and pump stations, transmission and distribution systems and collection and conveyance systems will "walk out the door."

A systematic program should be launched to capture the knowledge of experienced employees before they leave the utilities. Capturing this knowledge and building it into standard operating procedures and training will significantly benefit the utilities and their customers. While it may be impossible to document all the knowledge that seasoned employees have, a plan for capturing the most critical knowledge should still be undertaken. Since resources (i.e., funding and staff time) for capturing knowledge can be scarce, it is vital to prioritize what should be included in such a plan. The utility should determine what knowledge needs to be captured, what the risks and consequences of not capturing the knowledge are, how the knowledge will be captured and how that information will be disseminated to those who need it when they need it.

Actions should be undertaken to institutionalize the knowledge held by key employees nearing retirement with updated and additional written standard operating procedures along with mentoring or "shadowing" programs. Management should sit down with those employees who plan to leave the utilities within the next year and analyze what unique or critical knowledge each employee has. Based on this information, determine the importance, immediacy, feasibility and ability to capture and document the job-specific knowledge.

Knowledge Capture

Knowledge capture is essential for a utility organization since employees develop an intimate understanding of the utility system and utility business processes; their knowledge can help avoid future compliance and service issues while increasing organizational efficiency.

Baltimore City

Questionnaire respondents had a negative or no opinion of the DPW's knowledge capture process. None of the supervisors surveyed strongly supported the current process, and over 50% of supervisors said the process is not very active. This is an area warranting significant improvement.

Given the percentage of employees eligible to retire in the near future, the lack of a knowledge capture program is an issue. Once someone with decades of experience retires, that knowledge is gone. It was reported that the City used to have a rotational program in which staff was cross-trained on different job roles, but that program is no longer in place.

It was stated that the Department would like to implement mentoring and side-by-side work programs (especially for engineers and laborers early in their careers so they can get a big picture understanding). Utility and plant maintenance workers would also benefit from these sorts of programs.

It was also reported that the City also has several software systems and programs that do not interact with each other, making it difficult to find standard operating procedures or documented procedures.

Baltimore County

Like the City, the County does not have a formal knowledge transfer/capture process. Interviews indicate that some senior leaders recognize that the knowledge capture process is not working and that valuable data and knowledge are not being captured at present.

However, within its strategic plan for FY 2019 through FY 2022, the County has a key goal of "workforce development." The County plan identifies key success factors related to improve the work environment for its employees, such as increased retention rate for employees, increased diversity among the workforce, enhanced succession planning and enhanced workforce satisfaction.

Employee Salaries

Over the past four years, Baltimore County has conducted salary surveys for key County water and wastewater positions. As part of these surveys, the County compared salaries to those of other utilities and public works departments in Maryland, including Baltimore City, Anne Arundel County, Howard County, Montgomery County, Prince George's County and WSSC. The exhibit below compares the minimum salary and maximum salary for four position categories for the City, County and average of the other comparison utilities. The lowest minimum and maximum salaries for each position amongst the City, County and average of other comparison utilities are highlighted in red, while the highest salaries are highlighted in green. It should be noted that these surveys were conducted in different fiscal years (2016, 2017, 2018 or 2019) depending on the position reviewed, so they may not reflect the most current salaries in place.

Exhibit 3-23. Salary Comparison

	Minimum Salary			Maximum Salary		
Position	City	County	Average Comps	City	County	Average Comps
Utilities Superintendent	$60,655	$60,242	$77,498	$97,277	$93,853	$127,994
Utilities Supervisor I	$35,169	$50,365	$55,489	$49,188	$79,403	$91,537
Utilities Supervisor II	$42,131	$54,998	$57,271	$60,371	$87,540	$94,469
Environmental Laboratory Supervisor	$60,655	$60,242	$60,513	$97,277	$93,853	$101,483

Baltimore City

The salary survey data indicates that City starting and top salaries for Utilities Supervisors I and II are significantly below (and therefore not competitive with) Baltimore County and the other regional utilities.

For example, the starting salary for a Utilities Supervisor I in the City is roughly $15,000 less than in the County, while the starting salary for a Utilities Supervisor II is almost $13,000 less than in the County. Compared to the average of other comparison utilities, the contrast is even greater. In only one instance is the City salary highest among the others: minimum salary for Environmental Laboratory Supervisor.

In our interviews, it was also reported that engineering positions within the City DPW are not competitive as they are often recruited by private engineering firms. This means that the City ends up as a training ground for other utilities and private firms.

It was also reported that the City conducts salary surveys from time to time but that skilled/technical positions (like water and sewer operators) were often grouped with less skilled positions (like laborers) when comparing salaries. The project team could not confirm this as we did not receive any salary surveys from the City as part of the data review.

Baltimore County

As shown in the exhibit, County salaries are more competitive than City salaries for Utilities Supervisor positions. However, they are still less than the average salaries of other comparison utilities.

For the Utilities Superintendent and Environmental Laboratory Supervisor positions, the County has the lowest starting and top salaries when compared with the City and other comparison utilities. For example, the maximum salary for a County Utilities Superintendent is listed at $93,853, which is significantly lower

than the other jurisdiction. The County maximum salary in the study for a Utility Superintendent is about $34,000 lower than the comparison utilities' averages.

Responses to the questionnaire indicate that many supervisors believe the current salaries for water and wastewater staff are low. They think that County salaries are not competitive with the private sector and that the current salary scale is an impediment to hiring the most qualified candidates.

Contractors and Consultant Staffing

As part of the questionnaire and interviews, the project team asked key DPW leaders if they believed the City or County had struck the right balance of employees and contractors/consultants.

Baltimore City

City supervisors were split on whether the City has struck the correct balance. One respondent noted an imbalance between City employees and consultants and that (as supported by salary surveys) the City is not competitive with the salaries of private companies.

Another interviewee stated that the degree to which contractors control the City's billing system is an issue, which has lent to internal management and staff not understanding the billing system.

It was also stated that too much reliance on contractors had diminished the knowledge maintained in-house. For example, there is a heavy reliance on engineering firms, which has affected the internal engineering experience of the Department; not as many employees, including those in management positions, have professional engineering licenses (PE) as you would expect.

It was also stated that reliance on the same three or four firms for support also affects the utility's ability to receive competitive bids on projects.

Baltimore County

County supervisors were also split on this question. Some supervisors believe the County has struck the right balance, while others believe the County relies too heavily on contractors and consultants. Only two supervisors attempted to explain the reasoning behind their opinions. One supervisor stated it is not in the County's best interest to be overly dependent on consultants. Another supervisor believes the County needs to rely on consultants due to the City's data issues and lack of continuity.

Analyzer Offices

The Water Analyzer Office (WAO) has historically played an important role in City and County drinking water system management. Currently, the County is predominantly staffing the Office. The City has historically staffed the Office, but it was reported that currently, there is no permanent City staff assigned to the Office; it was mentioned that there were some junior level engineers from the City that assist. It is unclear why no City staff are currently is assigned to this critical office.

The Wastewater Analyzer Office (WWAO) was created as a wastewater counterpart to the WAO. Over time, City and County WWAO staff were relocated, leaving only one County employee at the Ashburton Water Filtration Plant (where the Office was located). In 1993, the last staff member was returned to the County offices in Towson, and the office was eventually dissolved.

Strategic Plan

Baltimore City

A DPW strategic plan was developed in 2014 with assistance from consultants. The plan was well developed and followed for up to 18 months. However, there is no strategic plan currently operative for water and wastewater operations only. The project team was informed that the City DPW intends to have an updated strategic plan developed but that it has been placed on hold until a new permanent Director of Public Works is in place. Public Works has released transition reports but not a formal plan. There have not been any transition plans released for water or wastewater.

Baltimore County

Baltimore County has developed a strategic plan to establish its strategic direction for FY 2019 through FY 2022. One of the plan's key goals is "workforce empowerment," which demonstrates its recognition of the essential role played by its employees. In the strategic plan, the County pledges to assess and promote staff classification and compensation equity and competitiveness. The County outlines five key strategies for workforce empowerment:

1. Develop, refine and promote employee and leadership development training
2. Review and enhance programs that promote and encourage employee safety and well-being
3. Assess and promote staff classification and compensation equity and competitiveness
4. Establish and promote a culture that encourages communication and collaboration across County staff and leadership
5. Build and strengthen the relationship between County government and communities

Communications

Timely and effective communications are essential for a utility organization. Free and open communications are the lifeblood of a high-achieving organization. Communications are important at all levels of an organization, from the top management level to communications between field work crews.

Baltimore City

The questionnaire results indicate that supervisors believe the City has done an excellent job of communicating strategic goals, mission, objectives and priorities. This is a very positive finding.

Supervisors also indicated that communications and guidance from supervisors are sufficient.

Supervisors were generally positive about communications from top management. However, it was stated that there is concern over uncertainty due to change in City administration.

Baltimore County

Based on questionnaire responses, the County has effectively communicated its strategic goals, mission, objectives and priorities to employees. All of the supervisors surveyed agreed that the County has done an excellent job communicating its strategic goals, mission, objectives and priorities.

A very positive response was also received concerning communications between questionnaire respondents and their supervisors. Over 80% of respondents agreed that communications with their supervisor were sound and timely.

Communications from top management did not receive strong positive reviews. Supervisors believe more frequent communications are needed from top management. Supervisors also think that top

management communications need to be timelier, especially during the pandemic as employees are anxious about their jobs.

Job Satisfaction and Morale

Baltimore City

Of the DPW supervisors who responded to the questionnaire, most are very satisfied or satisfied with their jobs. One respondent indicated they liked to work from home and hoped that the practice would be continued. Another respondent did not like their office location and reported the need for more archive space.

Most of the questionnaire respondents reported that the morale in their department was good or very good. One employee noted that management was working hard to maintain morale during the pandemic and that personal protective equipment (PPE) is available every day. Another respondent indicated the need for more communication, while another respondent stated that employees are interested in higher pay.

One supervisor stated that some groups have morale issues and that DPW was working on changing the management and leadership culture to address it.

Baltimore County

Two-thirds of questionnaire respondents are satisfied with their jobs, but several supervisors indicated the opposite. Those supervisors pointed to the need to improve communications, promote a better "life/work" balance, set more reasonable performance expectations and more freely share data.

The questionnaire responses on employee morale were mixed. While most supervisors believe that employee morale is good, a third of supervisors believe employee morale is low. The data appears to show that employee morale is high in some work groups but not in others. Actions identified to improve morale included better communications from top management, improved discipline of poor performers, and increased staffing and pay.

Human Resources Support

Baltimore City

Responses to the questionnaire indicate that some supervisors are satisfied with the support received from Human Resources (HR), while others want HR to better team with operations. Several supervisors noted that the organization does not do a good job addressing poor performers and working with them to improve their performance. No supervisors offered examples or recommendations for improving the disciplinary process or the implementation of HR policies. One employee stated that management should continue to build and expand on the equity program throughout the organization and that excellent progress had been made so far.

Baltimore County

Questionnaire responses on the effectiveness of human resources support were mixed. Of those that offered feedback, some said the HR hiring process was far too lengthy and caused good candidates to take other jobs. Throughout the questionnaire, responses indicated that supervisors believe HR needs to reevaluate the pay scale to attract qualified employees. One respondent cited the need to review all HR policies and procedures to determine if they are necessary.

Job Specifications

A critical element of an effective utility is accurate job specifications (i.e., job descriptions) that ensure employees understand their day-to-day responsibilities and the critical role they play in the organization's success. The project team reviewed several DPW job specifications as part of this study.

Baltimore City

Responses from supervisors indicate that all believe their job specifications are very accurate or somewhat accurate. Job specifications did not articulate the importance of City employees coordinating and communicating with County personnel regarding shared water system responsibilities. For example, the job specification for the "General Superintendent of Utilities Maintenance & Repair" states the position is responsible for, among other duties, maintenance and repair of the water distribution system in the City and County. The class specification requires the Superintendent to establish and maintain effective relationships with other City agency personnel, agency and contractual engineering personnel, vendors and community organization but not Baltimore County.

Baltimore County

Two-thirds of key supervisors reported that the job specification for their positions was very accurate or somewhat accurate. A smaller percentage of employees said that their job specifications were not at all accurate. Several respondents noted that their job specification did not include a full list of their job responsibilities and indicated duties not listed.

Performance Reviews

Employee performance reviews are an essential part of providing constructive input to an employee and identifying actions to correct deficiencies and improve performance. Regular reviews of performance help supervisors provide feedback and improve future employee performance.

Baltimore City

Questionnaire respondents provided different answers on the frequency of formal job performance reviews, ranging from once per year to up to three times per year. One respondent said formal reviews were not provided at all.

Baltimore County

Questionnaire respondents reported that employee performance is assessed on an annual basis. One supervisor was optimistic about the current employee review process. However, the vast number of responses indicates that the process is not held in high regard by supervisors or employees. One supervisor stated that employees think reviews are unnecessary as they do not benefit from receiving a good evaluation. Another respondent said that employees never receive a negative review because supervisors have to work with them daily.

Impact of the COVID-19 Pandemic

The most recent challenge facing the City and County water and sewer organizations is the continuing impact of the COVID-19 pandemic. Each has effectively responded to this crisis and has continued to provide essential water and sewer services to residents while still protecting its employees' safety and health. However, the COVID-19 impacts on water and sewer operations have been profound and will affect future operations.

The pandemic's financial impacts upon the water and sewer operations will be felt for many years to come. Unlike other businesses, water and sewer services cannot be "shut down" during a pandemic. Citizens must always have reliable drinking water and sound wastewater services despite the many challenges of a pandemic.

Baltimore City

During the onset of COVID-19, all meter readers were placed on leave (and billing halted) to mitigate the disease's spread. Meter reading eventually continued as several meter readers were brought back. The City and County then hired a contractor to assist with meter reads. The pandemic has affected the annual water cost allocation settlement between the City and County. See *Task 5 Assess Meter to Cash Operations* for more information on the impact COVID-19 has had on billing. It was reported that PPE for employees has been available and provided daily. It was also reported that management has worked hard to maintain morale during COVID-19, with some employees working remotely and some frontline workers receiving various perks (e.g., periodically provided lunches, snacks and other appreciative events.

Baltimore County

County DPW has had to modify its operations and staffing due to COVID-19. Teleworking has been implemented for many employees, and a lot of training has been put on hold or is being conducted remotely. It was reported that due to COVID-19, the workweek for utility employees had been revised to protect people from becoming infected. Overtime has also been eliminated as there are now more employees on shifts throughout the day. It was also reported that there is a Safety Officer position that is currently vacant and, due to COVID-19, filling that position has been put on hold.

Proposed County Prevailing Wage Legislation

The County Executive has introduced legislation that would mandate the payment of the prevailing wage for County-funded capital projects. The legislation also would require at least 51% of all new jobs for these projects to be filled by Baltimore County residents. If approved, the legislation will take effect on July 1st and would apply only to capital contracts or projects put out for bid beginning July 1st. Baltimore City currently has a prevailing wage policy.

Input received in questionnaire responses noted that the County should have concurrently committed to paying County employees the prevailing wage, not just contractors and others. The impact of the proposed legislation on capital project costs was also cited as an issue, although County management does not believe the effect will be significant.

Employee Discipline Process

Organizations must have a fair and objective employee discipline process. Studies indicate that the failure to address poor performers often results in the deterioration in higher-achieving employees' performance.

Baltimore City

When asked how well the City identifies poor performers and works with them to improve their performance, most questionnaire respondents did not have an opinion or provided a neutral choice (between well and not well). Other respondents thought identifying and working with poor performers was not handled very well, while another thought it was handled somewhat well. No respondents provided comments supporting their choices.

Baltimore County

The questionnaire results are mixed on the employee discipline process, with over 40% of the respondents not offering an opinion or providing a neutral choice. One supervisor expressed the view that the County has never terminated anyone for poor performance. Another supervisor stated the only way a person gets fired is for "stealing, fighting, drugs or not showing up for work."

Improving Efficiency and Effectiveness

The project team asked questionnaire respondents on how to improve organizational efficiency and effectiveness and how the City and County could deliver service excellence to water and sewer customers.

Baltimore City

Supervisors provided thoughtful responses to the questionnaire on how the DPW's utility processes and procedures could be improved over time, stressing the following needs:

- Improved internal and external communication
- A clearer definition of roles and responsibilities
- Independence from politics
- Better technology and software
- A strong, long-term vision unaffected by transitions in administrations
- "Servant leadership" in which managers and leaders need to focus on serving their teams
- Modification as to how the HR, procurement and training support functions work with operations staff

Baltimore County

County respondents provided the following responses for improving efficiency and effectiveness:

- Having the County assume responsibility for maintaining the public water system in the County (mentioned by more than one respondent), specifically related to meter maintenance, billing and pipeline maintenance
- Improved interaction with the City
- Increased staffing and opportunities for employees to grow in their careers
- Facilitated strategic planning sessions at the department level
- Adjustments to salaries so that County compensation is competitive with that of other utilities and private firms

Summary Observations

The following observations are strengths, constraints and opportunities for the City and County water and wastewater utilities. Unless specified, the observations apply to both the City and County.

Strengths

- The City and County have done a commendable job of effectively communicating objectives and priorities to their employees.
- Aggregate responses from City and County supervisors indicate that they are satisfied with their jobs.
- Aggregate responses from City and County supervisors indicate that overall job specifications are accurate.
- The City and County have done a commendable job of mitigating the pandemic's impacts and providing PPE to employees.

Constraints

- The vacancy rates for DPW employees are worse than industry averages and support the need for effective workforce succession planning.
- Both the City and County are searching for a permanent Director of Public Works position. The lack of a permanent position has led to some critical decisions being postponed.
- There is a lack of succession planning, with several employees eligible to retire within the next five years.
- Several key positions have departed the workforce, and several key positions are being served in an "acting" capacity.
- The knowledge capture process is lacking, with little documentation of standard operating procedures. Once key employees retire, their knowledge will be lost.
- Starting and top salaries for several positions are not competitive with surrounding utilities and private firms.
- The over-reliance on contractors and consultants for essential water and wastewater functions has diminished the knowledge maintained in-house.
- A City DPW strategic plan has not been updated. Steps to achieve the workforce empowerment goals within the County strategic plan are not satisfactorily being undertaken.
- Performance reviews are not provided consistently across water and wastewater functions.

Opportunities

Staffing

- Staffing goals should be established and regularly tracked and reviewed by both operations and senior management. Data measured and reported should include vacancies, employee retention, job satisfaction, workforce succession preparedness, training hours, etc.

Retirement Risk Assessment

- A retirement risk assessment for key positions should be conducted, especially when significant retirements may occur in the next five years.

DPW Director Position

- A permanent Director should be hired as expeditiously as possible to increase organizational stability and enhance employee confidence.

Key Employee Succession Planning

- A three to five year succession plan should be created for key operations and management staff to prepare future leaders to seamlessly assume key leadership positions. The process should include internal and external education, training and the opportunity to learn in various areas of responsibility. The plan should be reviewed on a semi-annual basis and modified as necessary.

Root Cause Analysis for Recruiting

- A root cause analysis should be performed to identify the challenges encountered in recruiting qualified employees, especially entry-level employees. Supervisors should participate with HR experts to develop an action plan overseen by top management to address the challenges expeditiously. The speed by which new hires are identified and subsequently hired should be analyzed.

Partnerships with Local Education Institutions

- Partnerships and internships with local community colleges and technical schools should be established, with a focus on training future utility employees.

Backup and Understudy Staffing

- Where warranted, backup staff, or understudies, should be hired to work with key financial and operating personnel to build management depth and better document procedures and history.

Knowledge Capture Process

- A formal knowledge capture process should be implemented to capture the experience and expertise of employees retiring or otherwise leaving the organization. The process should be applied to water and wastewater operations, utility finance, billing, safety and other related functions. The process should include incorporating the knowledge captured into centrally managed standard operating procedures. Key retired staff should be interviewed to add their experience and expertise to the standard operating procedures (SOPs) or procedures.

Salary Study

- An independent study of salaries for key water and wastewater employees should be performed. The study should analyze data from utilities across the nation along with national databases. Action should be taken to establish competitive salaries, and the results of the study should be presented to employees.

Contractors and Consultants

- The use of contractors or consultants is necessary, but the organization's long-term strategy should be to hire and develop full-time employees. Management should view contractors and consultants as a short-term solution to address a particular service need.

Job Specifications

- Job specifications should be reviewed to determine if they accurately describe the core competencies required for the job. For example, planning, communicating and working cooperatively with utilities that operate nearby. Core competencies should be reviewed with staff during performance reviews to define gaps and identify training needs.

Strategic Plan

- Organizations should continue to ensure that employees at all levels of the organization understand their role in achieving the organization's mission and strategic goals. Strategic plans should be kept up to date, and steps should be taken to achieve the goals outlined.

Communications

- Top management should establish an open, collaborative culture and blend the organization into a single, cohesive team focused on common objectives. Team building activities should be commissioned for teams that must work together to ensure high performance.
- The top organizational executive should issue timely communications to employees on the current state of affairs, new initiatives and positively encourage the workforce to better serve their customers. Holding small group meetings and periodic worksite visits should also be utilized to connect with the employees who work diligently to serve citizens' best interests.

Performance Reviews

- The value of employee performance reviews should be emphasized, and meaningful reviews should be conducted periodically during the year. Job performance reviews should be objective and benefit both the employee and the organization. Outstanding performance should be rewarded with incentives to motivate continued high performance.

Impacts of COVID-19

- Lessons learned from the COVID-19 pandemic should be identified and chronicled into a pandemic response plan or made part of an emergency response plan.

Task 4
EVALUATE WATER AND SEWER SYSTEM PLANNING AND MANAGEMENT

Task 4 consists of nine subtasks related to water and sewer system planning and management:

1. Capital Programs
2. Water Loss Management Programs
3. Drought Response Planning
4. Safety Programs and Risk Mitigation Planning
5. Source Water Protection and Land Use Management Planning
6. Performance Management and Continuous Improvement
7. Inter-jurisdiction Communication
8. Information Technology (IT) Systems Review and Disaster Recovery
9. Sewer Capacity Planning

Each of these subtasks is examined in this report.

Task 4.1 Capital Programs

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review and summarize the City and County capital project planning approach and any specific capital programs that each entity has initiated and/or is currently developing
- Provide any high-level observations on the strengths, constraints, and industry best capital program planning practices
- Review, if any, joint capital program planning protocols between the City and County in the context of the water and sewer systems management

Methodology

The project team's evaluation of the capital improvement program (CIP) for each the City and County included the following:

- Review of capital program trends and the five-year CIPs
- Review of capital financing practices
- Review of capital program development and implementation procedures and comparison to best practices
- Identification of capital program metrics and a comparison of metrics to best practices
- Review of the two utilities' asset management activities; both utilities are in the early stages of advanced asset management programs (the County has recently entered into a contract for asset management), so our asset management review was limited to level of development (discussed further in this subtask) and selected metric analysis
- Conducted interviews with approximately 20 managers and staff to identify joint capital program planning protocols
- Performance of selective metric comparisons to identify how cost structures compared to similarly-sized utilities.

In performing the various analyses, we utilized the following sources:

- Metric comparisons utilized either the AWWA 2018 benchmarking results for combined water and sewer utilities (www.awwa.org/Resources-Tools/Programs/Benchmarking), the 2019 AWWA survey (https://www.awwa.org/Resources-Tools/Resource-Topics/Rates-Finance) or the 2019 California Multi-Agency CIP Benchmarking (MAB) Study (https://eng.lacity.org/camb).
  - The annual AWWA benchmarking survey has been conducted almost continuously since 2002. The performance measures utilized in the survey were industry-developed; most of the AWWA benchmarked utilities are high performers – 93% of the utilities have a prime bond rating. The AWWA survey includes most of the large municipal utilities in the U.S.
  - The Multi-Agency Benchmarking study has been conducted for about 20 years and has analyzed thousands of municipal construction projects. Two of the five categories of construction projects analyzed in this study are water and wastewater treatment plants and pipe systems (distribution and collection). MAB was our source for Best Management Practices (see discussion below).
- We utilized a self-assessment survey instrument to identify how advanced the two capital programs were. Utilizing systems and methodologies to identify level of development[1] is an old practice; it has been utilized as part of AWWA benchmarking for 20 years. Much of the self-assessment instrument

[1] Level of Development relies on the fact that, as one goes from a basic capability to world class, additional capabilities and practices are added.

is similar to one utilized in the recent evaluation of WSSC as one of the lead consultants on this study was part of the WSSC study team.

- The Multi-Agency Benchmarking study served as our source for performance benchmarking and best management practices (BMPs) as defined by MAB below:
  - "Performance benchmarking is conducted to establish relationships between project delivery costs and total construction cost (TCC). The study examines how these relationships change over a five-year trailing period. This is a core concept of the study as it provides a meaningful benchmark by which participating agencies can assess their project delivery performance and identify potential reasons for differences between them and peers."
  - "Best management practices are discussed between agencies and tracked to provide participating agencies a living archive of practices being implemented by peers, lessons learned through their implementation and potential benefits to be derived if implemented."
  - "Over the years, the study has included thousands of projects. Each year, the project database is updated with the inclusion of project data submitted for that study year and updated project data submitted for previous years. The updated 2019 database includes a total of 596 projects, 476 of which belong in the 80th percentile subset by total construction cost."

Summary of City and County Practices

Exhibit 4-1. Summary of City and County Practices - Capital Programs

Element	City	County	Comments
Capabilities	▪ Substantial in-house capabilities except for design and geotechnical (contracted out)	▪ Substantial in-house capabilities except for design, geotechnical and environmental (contracted out)	▪ Evaluation looked at 11 elements
Program Development Process Consent Decree	▪ Major capital program ▪ Although consent decrees were separated by EPA, monthly coordination meetings are held with the County.	▪ Major capital program approaching its end in 2025 ▪ The County is beginning to transition to asset management	▪ Consent decrees have different dates and were negotiated separately by EPA (see sewer capacity planning for more details)
Program Development Process CIP	▪ The City has several large projects (consent decree, disinfection byproducts, aging infrastructure, etc.) ▪ The City's CIP production process is well developed	▪ A major portion of the County's CIP is for joint City-County projects ▪ County-only projects tend to be more demand-responsive ▪ Beginning to document process	▪ The City's process is top-down (dominated by large projects) ▪ The County's process is more bottom-up ▪ Inter-jurisdictional communications have an impact on County CIP development (see *Task 4.7 Inter-Jurisdiction Communication*)
Use of Metrics	▪ The City has a well-developed set of metrics	▪ The County has a well-developed set of metrics	▪ These are both excellent programs; however, they are used mostly to establish boundary conditions, not to manage processes (see comment #2)

Exhibit 4-1. Summary of City and County Practices - Capital Programs

Element	City	County	Comments
Program Level of Development	▪ A self-assessment of 10 capital program elements resulted in an average grade of 3 on a 1 to 5 scale	▪ A self-assessment of 10 capital program elements resulted in an average grade of 3 on a 1 to 5 scale	▪ This is an extremely detailed assessment that looks at practices, capabilities and systems ▪ The grade of 3 reflects a competent organization (see comment #3)
Implementation of Construction Best Management Practices (BMPs)	▪ The City has a high awareness of BMPs, utilizing 45 of 53 BMPs when appropriate	▪ The County has a high awareness of BMPs, utilizing more than 2/3 of the BMPs	▪ See comment #4
Joint Planning Process	▪ Under the 1972 agreement, the WAO was to be the mechanism for Joint Planning ▪ Around 1980, the WWAO was created as a wastewater counterpart to the WAO	▪ The WAO is predominantly staffed by County personnel ▪ The City and County WWAO staff stopped being co-located in 1993	▪ The existing system works (see *Task 4.7 Inter-Jurisdiction Communication* and *Task 4.9 Sewer Capacity Planning*) ▪ WAO needs to be staffed as originally intended ▪ Process works in an ad hoc fashion but should be formalized
Metric Comparison	▪ Compared to other utilities of comparable size, the City has higher debt per capita and is less affordable (average bill/median household income)	▪ Compared to other utilities of comparable size, the County has higher debt per capita and is less affordable (average bill/median household income)	▪ High debt per capita is indicative of large, high-cost capital programs ▪ Affordability is a computation involving both average bill size and median household income of customers

Background

Under the 1972 agreement between the Baltimore City and Baltimore County, the General Assembly of the State of Maryland determined that Baltimore City had a statutory obligation to provide water to the Metropolitan District of Baltimore County (Metro) at cost and that the County had a corresponding obligation to pay the actual costs incurred by the City for capital investment, operations and maintenance and the management entailed in the provision of water to the County. The agreement also noted that the City supplies filtered water to portions of Anne Arundel and Howard Counties and raw water to portions of Carroll and Harford Counties. The agreement established the methods by which the capital and operating costs of the system would be allocated between the City and County, as well as establishing capital program responsibilities of the City and County.

The agreement identified various responsibilities:

- Each party to the agreement was to be responsible for the planning, design and construction of filtered water facilities within its boundaries, except as authorized by the Acts of the General Assembly. Each party contributing to the cost of filtered water facilities constructed by the other party was to have the right to review reports, plans and financing of the facilities.

- The planning, design and construction of all raw water facilities, raw water pipelines and treatment facilities shall be the responsibility of the City. The County shall have the right to review reports and plans of these facilities. The financing of these facilities, including the sharing of engineering and other costs, were to be the subject of future agreements.
- To plan for future increases in capacity of these facilities and construction of new facilities, the agreement called for the City and County to continue to maintain a jointly staffed office to make detailed studies of the Baltimore Water System. Assigned personnel and associated costs were to be borne by the providing jurisdiction. All other costs for this office were to be allocated. During the past decade, staffing by both the City and County has been minimized, with the Office principally staffed by County personnel. Through conversations with staff, it is evident that system knowledge rests in the minds of long-term staff. Minimal, if any, formal documentation of procedures and processes currently exists, preventing extremely limited continuity of work in case of staff absence.

Findings

Capital Responsibilities

Under the various agreements, the allocation of capital program responsibilities for planning, design and construction is as follows:

Baltimore City

- Responsible for all water distribution system, and related, assets (pumps, storage, etc.)
- Responsible for all water treatment plants
- Responsible for wastewater conveyance systems within the City, including portions that accept County wastewater for conveyance to the City's wastewater treatment plants
- Responsible for wastewater treatment plants

Baltimore County

- Responsible for water system components that benefit only the County
- Responsible for wastewater collection system and related assets within the County

Under these agreements, certain analyses that assist in planning and perform the calculations that result in the allocation of capital costs between the City and County are the responsibility of jointly staffed offices as described previously. Currently, there is no longer a physical jointly staffed wastewater office; however, at least one County employee identifies as working for the Wastewater Analyzer Office and both City and County personnel carry out WWAO activities.

Assets Managed

The following exhibit highlights capital assets in the City and County:

Exhibit 4-2. City and County Capital Assets

Asset	City	County	Comment
Water Plants	3	2 small plants	Combined capacity of 405 million gallons per day (MGD)
Wastewater Plants	2	1 small plant	Capacity of 200 MGD
Water Distribution System	4,500 miles (system)	2,270 miles	
Wastewater Collection System	3,100 miles (system)	1,477 miles	

Baltimore City, through the Bureau of Water and Wastewater within the Department of Public Works, provides water to a service area of approximately 220 square miles, with 80 square miles within the City and 140 square miles outside of the City's limits. With approximately 4,500 miles of water main, ranging in diameter from 3 inches to 144 inches, the water system serves Baltimore City and parts of Baltimore, Anne Arundel, Carroll, Howard and Harford Counties. The water system serves over 1.8 million people and supplies approximately 72.1 billion gallons of water annually, of which 32 billion gallons are used within City limits. The water system provides water to the County at retail rates, to the Counties of Howard and Anne Arundel at potable wholesale rates and the Counties of Harford and Carroll at wholesale raw water rates. To adequately provide water distribution, the City water system has 30 storage facilities (capacity of 420 million gallons) and 20 pumping stations (pumping capacity of 618 million gallons per day). A breakdown of metered accounts are as follows:

Baltimore City	194,902
Baltimore County	208,065
Anne Arundel County	12
Howard County	4
Carroll and Harford County	5
Total	402,988

Baltimore County, through the Bureau of Utilities within the Department of Public Works, provides water and sewer services to more than 847,000 residents over an area of 682 square miles. In addition to the horizontal assets listed above, the Bureau manages multiple buildings at two locations and one small wastewater treatment plant.

Capabilities

The Engineering and Construction component of Capital Programs consists of several functions, some of which are performed in-house and some of which are contracted by the City and County:

Exhibit 4-3. Engineering and Construction Functions

Function	City	County
Planning	100% in-house	100% in-house
Design	100% contracted	contracted (mostly)
Geotechnical	100% contracted	100% contracted
Construction Management	80% in-house	95% in-house
Survey	100% contracted	in-house ranges from 25% to 90%
Real Estate	70% in-house	99% in-house by Real Estate Compliance
Estimating	100% contracted	25% in-house (overall) 80% in-house (water only)
Environmental	100% contracted	10% in-house
Scheduling	50% contracted	75% in-house
Inspection	40% contracted	50-60% in-house

Exhibit 4-3. Engineering and Construction Functions

Function	City	County
Compliance (testing and lab)	100% contracted[2]	50-80% in-house
Systems/Processes Start-Up and Staff Training	25% contracted	N/A

The City and County are each respectively required to annually present a one-year capital budget and five-year capital improvement program. The funding for the capital budget is principally from the issuance of debt. The amount of debt permitted is subject to various factors, including but not limited to rate elasticity, debt capacity limitations and debt coverage limitations.

The City prepares the capital budget and CIP utilizing a computer model, which incorporates the appropriate limitations. Based on the results, applicable management staff is advised as to the maximum annual amount that can be submitted for each year. Staff determines the projects and amounts to be included in the annual budget. The annual CIP is less detailed but provides a realistic picture as to the extent of the budget level the City can expect over the upcoming five years.

In preparing the annual capital budget for the County, management ascertains the total amount that can be supported by similar means as the City. However, the preparation of the CIP incorporates most, if not all, of the capital work management considers necessary to complete. As the years in the CIP become closer to the specific budget year, these amounts become fine-tuned to reflect totals that the County can afford.

Major Capital Programs

Both the City and the County have conducted substantial capital programs because of their sanitary sewer overflow (SSO) consent decrees; the City's consent decree was finalized in 2002, while the County's was finalized in 2005.

The County's consent decree work will conclude around 2025. As a result, the County has begun its transition to asset management to begin the process of replacing and rehabilitating its aging infrastructure. Most of the County's other capital programs, besides the consent decree and asset management (renewal and rehabilitation projects), are demand responsive work supporting growth or state highway projects.

The City's consent decree work has received a schedule and additional work as part of its integrated plan (see next section). On the water side, compliance with the EPA's disinfection byproducts rule (also under a compliance schedule) resulted in a decision by the City to replace all uncovered finished water reservoirs, at a cost of around $500 million. The City is also dealing with aging infrastructure, which will require substantial capital investments far into the future.

Capital Program Development

Baltimore City

The water, wastewater, and stormwater utilities are separate and distinct and must be operated and maintained through utility rates, without profit or loss. The water and wastewater utilities prepare capital improvement programs annually, which incorporate a one-year capital budget and five-year capital

[2] The project team was informed that the City maintains staff to perform basic functions and is in the process of bringing functions back in-house. The City is also seeking to develop accredited labs.

program. The City utilizes an Integrated Planning Framework (IPF) to plan and prioritize all capital projects. These recommendations are submitted to the Director of Public Works for public hearings, after which the Planning Commission sends the CIP to the Board of Estimates and the Department of Finance. After review by both agencies, the Board of Estimates approves both the capital budget and five-year capital program and forwards it to the City Council for final approval. It should be noted the City Council has authorization to make reductions to the proposed capital improvement program but cannot increase any part of the proposed capital program. Also, all debt service must be covered by utility funds paid by ratepayers. No General Fund monies can be used.

Water Utility

The City's water utility capital improvement program addresses capital improvements in the areas of supply, treatment, storage and other programs, including annual replacement of plant and utility services. The City uses an IPF to prioritize water-related capital projects. Major specific projects include Ashburton WashWater Lake dredging ($29 million), Montebello Lake dredging ($91 million) and distribution system improvements ($759 million). Distribution system improvements include water main replacement, water meter replacement, valve and hydrant replacement and pump station enhancements. Within the capital program are capital improvements that benefit Baltimore, Howard and Anne Arundel Counties. Approximately $188 million of the capital improvement program represents projects which benefit these counties.

Treatment Plant	$119,756,000
Pump Stations	41,662,000
Water Main	540,090,000
Meter	89,822,000
Bridges	4,295,000
Facilities	79,472,000
Valves and Fire Hydrants	2,592,000
Druid	949,000
Other Facilities	37,506,000
Dam Rehab	7,020,000
SCADA Upgrade	3,600,000
Watershed Improvements	5,411,000
Total	$932,175,000

Wastewater Utility

The City also uses an IPF[3] to assist the wastewater utility in prioritizing the most beneficial projects and in the appropriate sequencing and scheduling of projects.

From time to time, the wastewater utility will have capital projects which are beneficial to Baltimore and Anne Arundel Counties. In these instances, intermunicipal agreements are executed whereby the respective county agrees to reimburse the City for an agreed-upon proportional share of the project cost. Within the current five-year capital improvement program (with project costs totaling $604 million

[3] In June 2012, the Environmental Protection Agency issued a framework entitled Integrated Municipal Stormwater and Wastewater Planning Approach Framework for the purpose of assisting states and local governments in developing voluntary storm and wastewater management plans that will offer the greatest opportunity for cost-effective and protective solutions and implementing the most important projects first.

through Fiscal Year [FY] 2025), Baltimore and Anne Arundel Counties are expected to reimburse the City $245 million.

The following summarizes the wastewater utility's capital program from FY 2022 through FY 2026:

Treatment Plants	$391,200,000
Sewer Shed/ Main Rehab	149,000,000
Facilities	24,000,000
Flow Monitoring	3,200,000
Pumping Stations	36,600,000
Total	$604,000,000

Baltimore County

Under the Metropolitan District Act, the Metropolitan District was established as a separate and financially self-supporting entity under the jurisdiction of the County to supply water and to provide sewerage and drainage systems to residents of the County living within certain prescribed areas. The Metropolitan District has its own revenue and bond issuance powers, subject to authorization by the County Council. The following provides capital budgeting information relevant to both the water and wastewater utilities within the Metropolitan District.

The Planning Board is charged with the responsibility of recommending a capital improvement program to the County Executive after gathering information from the applicable department(s) within the Metropolitan Water District as well as input from the community and neighborhood perspective. The County Executive is permitted to change the CIP recommended by the Planning Board, but any change must be pointed out to the County Council in the Budget message. The following provides capital budgeting information relevant to both the water and wastewater utilities within the Metropolitan District.

Water Utility

The Metropolitan District's CIP for its water system consists of work in the areas of new water mains, replacement water mains, fire hydrants and other infrastructure requirements and currently represents approximately 43% of the current CIP. Also included in the capital program is Baltimore County's proportionate share of work, which benefits both the County and City. These amounts represent approximately 57% of the current CIP.

Wastewater Utility

DPW and the County's Office of Budget and Finance are responsible for preparation of a capital budget and five-year capital improvement program, which are submitted to the Planning Board for adoption. The capital budget and five-year program incorporate the County's need for new construction, sewer line relocations, replacement and miscellaneous improvements. These projects represent approximately 58% of the Metropolitan District's current wastewater capital program. The County's proportionate share of wastewater projects (which are determined beneficial to the County and City) are also included. These projects represent approximately 42% of the CIP.

Use of Metrics

Both the City and County utilize metrics to help manage their programs. The following exhibit summarizes metrics used, actual values (where provided) and boundary conditions:

Exhibit 4-4. City and County Metrics

Metric	City	County
Bid price to engineers estimate	▪ Bids are not awarded if in excess by 10% ▪ Any statistical information related to bids between 1-10% is available but was not provided ▪ All bids are subject to approval by the City Board of Estimates	▪ Tracked; 5% over is considered excellent, 10% over is good and over 20% over requires written justification (rarely happens)
Average number of bidders per solicitation	▪ Information is available but was not provided ▪ City notes data is in electronic form and available for any project ▪ Review process is extensive and well documented	▪ Pipeline projects: 4 ▪ Sewer relining: 5 ▪ Pumping stations: 2 to 4 ▪ Rehab projects: 6 ▪ Cut and cover: 6
Budget to actual ($)	▪ Information is available upon demand ▪ Staff examined a sample of 177 completed projects ▪ Results show actual cost at 88% of budget (as amended) ▪ Although any increased amendment to the project's original budget requires BOE approval, budget to actual statistics should be predicated on the project's original budget	▪ Tracked, 2% over is considered excellent, 2-5% over is good and 5-10% over is acceptable. See note 1
Planned vs. budget (schedule)	▪ Information is available on demand ▪ Based on the above 177 completed projects, 40 projects (23%) received time extensions	▪ Tracked
Change order %	▪ Information is available on demand ▪ Utilizing the above 177 completed projects, 6% of the original contracts had change orders ▪ Change orders are subject to approval by the Board of Estimates	▪ Tracked; cannot go over 20% without justification ▪ Only 2 projects have exceeded recently
Claims %	▪ Information is available on demand	▪ Tracked by construction inspection
Design cost as % of total	▪ Based on a 158-project sample review, design cost was 21% of total cost ▪ See note 2	▪ Not tracked on every project ▪ Estimated to be 15% ▪ See note 2
CM cost as % of total	▪ Tracked and maintained in electronic format	▪ Not considered applicable, not tracked

Notes:

1. Most issues on unit price contracts result from inaccurate bid quantities as opposed to scope changes, which rarely occur on water/sewer projects
2. Average MAB study design % for piping systems was 22% (80th percentile was 24%); average design % for water and wastewater plants was 24% (80th percentile was 27%). Since this is a ratio, a low percentage can be either the result of low design costs or high total project costs, or combination of both.

Self-Assessment of Capital Program Level of Development

A self-assessment survey was distributed to members of the capital program of both the City and County. The form was designed to identify the level of development of 11 capital program elements.

The concept of level of development is widely used in assessments and benchmarking. It relies on the fact that, as an organization goes from a basic capability to world-class, additional capabilities and practices are added. In this case, we defined three levels of capital program development for ten capital program elements and asked City and County personnel to self-assess using a three-point scale:

- Level 1 – Basic
- Level 3 – Competent
- Level 5 – World Class

As a note of caution to the reader, City and County personnel were only given three choices: 1, 3 or 5. It is possible that a rating of 3 (the most common in the survey) could have been given for a level closer to 2 or a level closer to 4.

The narrative following the exhibit below describes the elements of the level of development selected as well as the elements of the next higher level of development.

Exhibit 4-5. Capital Program Level of Development

Capital Program Element	City	County
Asset Knowledge	3	3
Risk Management Criticality	3	3
Risk Management – Asset Condition	3	3
Maintenance – Organization	3	3
Maintenance – Quality	3	3
Document Management	3	3
Inventory Management	3	3
Financial Accountability	3	3
CIP Production Process	5	3
Capital Delivery	3	3

To assist the reader, the following describes how the City and County self-assessed and what would be required to achieve the next highest level of development

Asset Knowledge: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of asset knowledge as one in which:

- Asset registry list is complete, including asset characteristics and including location in GIS (geographic information system)
- Key data is verified/validated periodically

Upgrading to a highly developed level of asset knowledge will require a robust asset management program that provides the following:

- An asset list complete with costs allocated for critical assets (replacement value)
- An asset registry updated in liaison with stock check-out, etc. (real-time)

Risk Management Criticality: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of risk management-criticality knowledge as one in which:

- Rules and assessment processes are well-defined, with progress being made but not yet fully complete
- Criticality is well organized, and initial evaluation is done across all assets

A robust asset management program should upgrade this element into one in which:

- Criticality updated procedures are in place for updating criticality as contextual changes occur (contractual, process, regulatory, legislation, etc.)
- Criticality and/or risk are the basis of various other strategies (maintenance organization, inventory management, budgeting, etc.)
- Advanced failure mode and effects analysis (FMEA) studies are performed on critical assets

Risk Management – Asset Condition: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of risk management-asset condition knowledge as one in which:

- Some formalization and good understanding of condition assessment is involved (approach and rules)
- Condition assessment rules, etc., are well established and are implemented and followed
- Condition monitoring (off-line) is applied to critical assets as needed

A robust asset management program should upgrade this element into one in which:

- A predictive/proactive maintenance strategy is fully developed
- A condition-based monitoring strategy is fully developed

Maintenance – Organization: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of maintenance organization as one in which:

- A preventive maintenance plan is in place
- Basic planning and scheduling are in place but not optimized
- Some or no costs are captured (the County tracks employee and equipment costs in both Cassworks and Cityworks)
- Maintenance staff competencies are periodically verified to align with work performed
- Training policy is in place and updated/verified periodically
- Planning and scheduling functions are well-defined, and all internal and contracted work is recorded
- Basic periodic reviews are performed, and basic cost controls are in place

Improving to the next level of maintenance organization would include the following practices:

- Monthly and yearly reports with performance indicators are produced and used to optimize plans with life-cycle focus (the City notes it utilizes six project performance indicators for the CD program and is looking to extend this to other areas)
- Failure analysis is performed for breakdowns on critical equipment and used to adjust the preventive maintenance (PM) plan and the renewal plan
- Internalization versus subcontracting decisions are assessed
- The PM plan is analyzed and updated based on at least three years of data for optimization
- Fully developed life-cycle maintenance plan
- Full cost-benefit analysis is performed
- Advanced reliability-centered maintenance (RCM), etc., techniques are in place

Maintenance – Quality: Level 3

In the self-assessment survey, City and County personnel estimated their current level of maintenance quality as one in which:

- Maintenance quality indicators were well defined relating to level of service (LOS), but implementation and benefit not yet mature
- Recording of staff hours is done as well as recording of spare part descriptions
- Indicators are used regularly to control and manage maintenance quality
- Links established between maintenance quality and equipment reliability that conform to LOS requirements
- A defined structure of incident escalation, analysis and reporting exists (example: root cause analysis) that includes prioritization and responsibility for follow-up action
- Maintenance techniques/skillsets are developed via an identification and formalization process

Improving to the next level of maintenance quality would include implementing the following practices:

- Benchmarked maintenance quality indicators
- Quality indicators and policies are regularly reviewed and improved related to LOS
- Maintenance quality is fully optimized following numerous cycles of continuous improvement
- improvement identifying and leveraging industry good practices

Document Management: Level 3

In the self-assessment survey, City and County personnel estimated their current level of document management as one in which:

- Process and instrumentation diagrams (PandIDs), construction documents, etc. available with a plan in place to update all documents
- Preventive and mandatory inspection documentation available
- Documents updated/verified

County personnel added:

- All preventative and inspection documentation is provided to the Baltimore City pumping section
- Final as-built construction documents are always put into the County electronic record inventory
- Inspection is done on pipeline cathodic protection systems
- Construction documents, etc. are available with a plan in place to update all documents

Improvements in document management would include the following practices:

- Process in place to update/verify periodically
- Document management system in place with documents available electronically
- Process in place to capture updates in real-time or as they occur

Inventory Management: Level 3

In the self-assessment survey, City and County personnel estimated their current level of inventory management as one in which:

- Criticality is understood and linked to identification of critical spares
- Spares are categorized and linked to equipment in the field
- A dedicated stock warehouse is in place
- Supply chains are understood and formalized
- If a procurement strategy is in place higher than the plant level, some participation occurs, but it is not optimized
- Criticality is completely linked to critical spare parts identification
- Stock warehouse has check-in/check-out process formalized
- Supply chains are well defined

Improvements in inventory management would include the following practices:

- Entity participates in inventory system standardized across all sites
- Common spares identified and available across the defined sites
- Automated stock re-ordering in place based on simple thresholds
- All wear parts are planned
- Intelligent automated stock re-ordering in place (not just static thresholds, but continually optimized/intelligence-based dynamic thresholds)
- Material requirements planning (MRP) process in place.
- County personnel added both positive and negative comments regarding City inventories. One employee stated that Baltimore City has a good inventory of supplies to repair broken pipelines and to do necessary repairs at pumping stations and treatment facilities. Another noted that Baltimore County keeps some supplies on hand to provide to City crews, so they don't have to travel back to the City. To reduce the time customers are without water, the County is currently purchasing over $100,000 in adaptors the City does not have on hand.

Financial Accountability: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of financial accountability as one in which:

- Maintenance costs are captured at process level but not well understood/performed
- Basic financial key performance indicators are in place
- Maintenance costs are captured at system level and to the asset level for critical assets
- Budget has granularity to asset level for critical assets, and planned and actual spending is tracked and forecasted
- Renewal costs and budgeting are understood and done but not optimized

Improvements in financial accountability include:

- Maintenance costs captured at asset level for all assets
- Maintenance budget optimized with long-term visibility
- Renewal costs and budgeting mature
- Full budget granulation, activity-based costing, full life-cycle costing management

CIP Production Process (City): Level 5

In the self-assessment survey, City personnel estimated their current CIP production process as one in which:

- Robust and structured processes are in place with continuous iterative improvement
- Well defined project prioritization criteria are developed for common comparison and assessment among all project types and triple-bottom-line based
- All projects are based on a consistent and well-defined level of service
- CIP budget is consistently met every year

CIP Production Process (County): Level 3

In the self-assessment survey, County personnel estimated their current CIP production process as one in which:

- Structured processes are in place, with defined project prioritization criteria developed
- Some projects are based on some criteria for LOS
- CIP budget is met in most years

Capital Delivery: Level 3

In the self-assessment survey, City and County personnel each estimated their current level of capital delivery as one in which:

- Informal performance management systems are in place and sometimes used to track project delivery performance
- Cost estimation is relatively accurate with respect to project bids; project budgets are usually met, and some project duration overruns may occur
- Project pipeline has visibility of at least five years
- Contracts are awarded on lowest bid only

Capital delivery improvements include:

- Robust performance management system is in place and utilized to track and report on key metrics of project delivery performance, as well as to set improvement goals
- Cost estimation is consistently accurate with respect to project bids, project budgets are consistently met, and project duration overruns rarely, if ever, occur
- Project pipeline has visibility of at least 10 years
- Indefinite delivery, indefinite quantity (ID/IQ) contracts are commonplace to improve contractor relations and project delivery
- Quality is formalized as the priority of ultimate project delivery, and contract award is based on multiple criteria, not just lowest bid

Baltimore County Only Assessments

Some Baltimore County personnel offered assessments of the City departments with which they interfaced:

Maintenance – Organization

- Pipeline Maintenance: 1
- Pump Stations and Treatment Facilities: 3

Maintenance – Quality

- Pipeline Maintenance: 1
- Pump Stations and Treatment Facilities: 3
- Inventory Management – Pump Stations and Treatment Facilities: 3

Financial Accountability

- Pipeline Maintenance: 1
- Pump Stations and Treatment Facilities: 3

Construction Best Management Practices

The Multi-Agency Benchmarking Study (described earlier) has identified 53 construction BMPs. These BMPs have been derived by analyzing the practices utilized in construction projects and correlating those to total construction cost. Over the years, the study has included thousands of projects. Each year, the project database is updated with the inclusion of project data submitted for that study year and updated project data submitted for previous years. The updated 2019 database includes a total of 596 projects, 476 of which belong in the 80th percentile subset by total construction cost (TCC). The 53 BMPs from the 2019 database and their rationales are presented in Appendix E.

The survey of both the City and County demonstrated a high level of awareness of BMPs. The City incorporates 45 of the BMPs, when appropriate. Of the eight BMPs not utilized, one is in the process of being developed and incorporated. The County incorporates from 35 to 40 BMPs (multiple departments participated) when appropriate.

The following exhibit presents the BMPs not utilized and the rationale for each (refer to Appendix E for more details on each BMP). [NOTE: If there is a blank, it means that the entity does utilize the BMP when possible]

Exhibit 4-6. BMPs Not Utilized

Construction BMP	City	County
Train in-house staff to use green building standards		No, by choice
Implement a rotating request for quote (RFQ) process for contracting small projects to streamline the bidding and award process during construction		No, by choice
Receive bids electronically	Against City Charter; equipment limitations	County purchasing rules prevent
Perform and use post-project reviews to identify lessons learned		No, by choice
Use a team-building process for projects greater than $5 million		No, by choice
Delegate authority below Council to make contract awards under $1 million	Against City Charter	County code prevents
Create in-house project management team for small projects		No, by choice
Adopt and use a project control system on all projects		No, by choice
Implement a work breakdown structure (WBS) to measure progress on project deliverables.		No, by choice
Establish the use of dashboards as a quick way to check project delivery performance for both internal and external reporting		No, by choice
Include a standard consultant contract in the request for quote/proposal with an indemnification clause		No, by choice
Delegate authority to the Public Works Director/ City Engineer to approve consultant contracts under $250,000 when a formal request for proposal (RFP) selection process is used	BOE must approve	County code prevents
Determine appropriate consultant costs for professional services agreements		No, by choice
Implement a rotating request for quote process for contracting small projects to streamline the bidding and award process during construction (include criteria for exemptions from formal Council approval)		Use other mechanisms for small projects
Use a formal quality management system		No, by choice
Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provision		Proposed but not adopted by DPW leadership
Implement electronic contract payment process		Cannot do – old systems
Institutionalize project manager performance and accountability		No, by choice
Implement verification procedures to ensure that project management training includes agency policies, procedures, forms and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc.)		No, by choice
Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery		No, by choice
Implement an electronic progress payment/schedule of values system to improve efficiency		No, by choice
Have awarding authority to approve plans, advertisement and award of contract in one board/council action	Outside DPW purview	

Exhibit 4-6. BMPs Not Utilized

Construction BMP	City	County
Delegate authority to the City Engineer/Public Works Director or other departments to approve change orders to the contingency amount	Anything above $25K must be approved by BOE	
Agency should file as-built drawings within six months of project completion	No, by choice (Facilities)	
Make bid documents available online	Provide CDs for large projects (working on it)	

Some observations regarding construction best practices:

- Some of the BMPs that the County does not implement by choice appear in the County's strategic plan and may be implemented in the near future
- The City intends to implement additional BMPs, including expansion of measuring performance indicators
- Charters, codes and procedures can always be changed
- See *Task 4.6 Performance Management and Continuous Improvement* for more findings and observations

Joint Capital Program Planning – Baltimore City and County

Under the City-County Water Agreement, the City and County agree to be responsible for their respective proportionate shares of capital projects that are mutually beneficial to them. In addition, Baltimore County must approve projects and certify the funds are available to pay its proportionate share of local costs. [Note: The County has received some unexpected invoices from the City. These have been either due to schedule issues (such as late starts) or scope increases reflecting work prior to the County agreeing via the concurrence process]

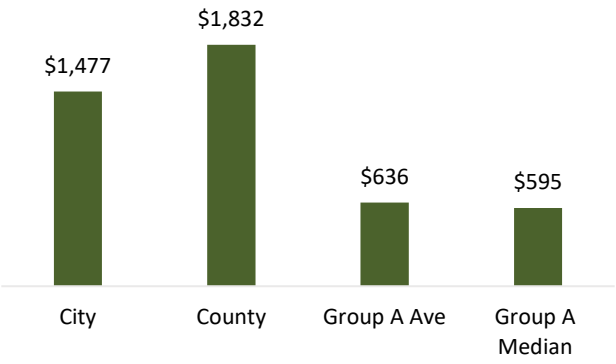
Responsibility for management and operation of the water and sewer facilities are under the City's Bureau of Water and Wastewater within the Department of Public Works. The Water Analyzer Office, located within the Water and Wastewater Engineering Division, is intended to consist of Baltimore City and County engineers as well as necessary supporting staff working cooperatively to evaluate and continually update the existing and future needs of the water and wastewater systems. During the past decade, staffing by both the City and County has been minimized, if not completely abandoned, with the Office principally staffed by County personnel. Through conversations with staff, it is evident that system knowledge rests in the minds of long-term staff. Minimal, if any, formal documentation of procedures and process exists, limiting continuity of work in the case of staff absence.

The City created what was called the Wastewater Analyzer Office around 1980 when previously Federal grant-funded Clean Water Act positions became permanent. The office was originally located in the Abel Wolman Municipal Building and later relocated to the Ashburton Water Filtration Plant to accommodate additional staff and field operations. Over time, City and County WWAO staff was relocated, leaving only one County employee at Ashburton until 1993, when the last staff member was returned to Towson. The current process consists of the City performing calculations and sending the results to the County. The County requests supporting documentation, frequently disagrees and performs recalculations. The County then provides its calculations to the City, with the revisions typically being accepted.

On water projects, the Water Analyzer Office (predominantly staffed by County personnel) performs the calculations as prescribed by the 1972 agreement and sends the results to the City. Although there have been some complaints, City personnel typically accept the results.

Debt per capita (person served) Metric

This metric compares the City and County to AWWA Group A utilities. These are the 36 largest utilities in the United States, with a median population served of 1.133 million.



Normally, we would have computed capital intensity (value of assets needed to generate $1 of revenue), but the assets that serve the County are not all on the County's balance sheet, so we computed debt/capita since the County issues debt to pay for their allocated assets in the City, as well as those in the County. [Note: This ratio is affected by the amount of PAYGO utilized by the comparison utilities. As we are making this comparison to large utilities, PAYGO tends to be a small percentage of capital costs. Therefore, this should be looked at as an indicative comparison, not a precise comparison.]

High-Level Observations

Overall, the two capital programs are classified as competent. The self-assessed level of implementation of the ten capital program elements is 3 on a scale of 1 to 5 (the City self-assessed their CIP production process at 5). Both the City and the County demonstrated a very good awareness of construction best management practices. There are several important observations from the data:

- Joint efforts do not satisfy the intent of the 1972 agreement.
- Both utilities are high cost. Although we could not compute a value for the County, we believe that both utilities are above average in capital intensity (dollars of assets required to generate one dollar of revenue). Some of the reasons are undoubtedly due to circumstance (aging infrastructure) and regulatory actions (consent decrees), but the capital program is likely a contributing factor. Both the City and County have asset management programs that should curb costs related to aging infrastructure.
- Both utilities have capital project metrics tracking programs, but the data collected seems to be used only to set boundary conditions (i.e., establish limits), not to manage performance.

The following discussion presents strengths, constraints, a review of joint capital program planning protocols between the City and County, a commentary on capital program staffing and a commentary on the two main survey instruments utilized in this analysis.

Strengths

- Both water and wastewater utilities have a process for capital program development, which is documented by the preparation of an annual capital budget and five-year capital improvement program.
- There is utilization of metrics to track project boundary conditions.
- The number of bidders per solicitation is indicative of a competitive climate that should produce good bids.
- The overall level of implementation of practices by program element is a 3 on a scale of 1 to 5. A score of 3 is classified as competent (5 is world-class).

- The awareness of construction BMPs ranges from 70% to 85%, which is good.
- Both capital programs have been able to carry out large programs.

Constraints

- The metrics program appears to be used mostly to establish boundary conditions. These metrics should be utilized to manage performance. Also, we encountered many cases in which we requested data or performance measures and were told, "we collect that data, but it will take a long time to get organized." Utilizing metrics requires not only the ability to gather the data when requested but also to have the data accumulated in a predetermined format automatically, which is distributed to pertinent personnel on a regularly scheduled basis (monthly, annually, etc.).
- A low-cost continuous improvement effort (conducting post-project lessons learned sessions) was a BMP not implemented by choice by both the City and County (see our commentary on project staffing). However, it was noted that the City conducts lessons learned meetings on consent decree projects and intends to extend this practice to other projects. Continuous improvement can also be performed during process documentation performed as part of succession planning.
- Project implementation periods are reported to be lengthy. Reviewing and modifying existing business practices and policies as well as implementing the BMPs currently not being utilized by the City will reduce these implementation periods.
- Lack of joint City-County planning (discussed in more detail below) constrains capital program efficiency.
- We could not identify a County project selection and prioritization methodology that reflected the County's strategic plan. As it moves into asset management, the County will begin having to make prioritization and selection decisions.

Joint Capital Program Planning Protocols

- The City and County are not meeting requirements of the 1972 agreement. The Water Analyzer Office is currently predominantly run by County personnel. City and County staff stopped being co-located in the same office in 1993. City and County staff serving these functions now primarily communicate by email.
- Personnel in both the City and County would like to see a return to the situation described in the 1972 agreement. Senior City staff expressed concern about the lack of City participation in the Analyzer office. County personnel have requested additional staff to work with and review City activity in joint projects.
- Appropriate staffing in the Analyzer Office of City and County personnel would help ensure coordination of effort in reflecting accurate joint project budgeting costs in both the capital budget and CIP.
- On a technical level, there were few signs of joint planning.

Commentary on Capital Program Staffing

During our discussions with City and County staff, we got the impression that the County staff consisted of long-tenured individuals and that there were above average amounts of turnover among City staff. The similarities between what we found and our experience with other capital programs that had either long-tenured individuals or high turnover may be instructive.

Organizations with long-tenured individuals tend to rely heavily on tacit knowledge. It is a more comfortable way to work and, when people have worked together for a long time, the job gets done. However, such organizations:

- Tend not to favor continuous improvement efforts

- Resist changes to new training materials and changes in procedures to improve efficiency, such as financial reporting and quality management systems
- Resist changes to project manager accountability
- Have gaps in project documentation in areas where individuals rely on tacit knowledge
- Tend to have longer project implementation periods than high-performing capital programs

A review of the BMP discussion will indicate that there are many similarities between this type of organization and the County engineering and construction staff.

The City appears to have good documentation, but there were a number of comments about the impact that high turnover had on performance.

Commentary on Use of Metrics and BMPs

One concern with self-assessments is the possibility of over-grading. We attempted to provide specific examples in the capital program self-assessment to limit over grades. It is possible, given a choice of 1, 3 or 5, that the average grade of 3 was the result of rounding up. It is important to note that there are programs and plans in place to improve these level of implementation scores.

We have a similar concern regarding the best management practice. Offering the choice “we do this when appropriate” may have allowed too much leeway. The highest performing utilities in the Multi Agency Benchmarking study report 80% full implementation of the BMPs.

TASK 4.2 WATER LOSS MANAGEMENT PROGRAMS

SCOPE

The City's Office of Asset Management tracks the water loss for the system's 4,000 miles of mains (City and County service area). The Office has recently initiated the AWWA/IWA (American Water Works Association/International Water Association) water audit protocols. The project team was requested to perform the following scope of services for this subtask:

- Review and summarize the overall water loss management process, including data capture, data validation and analytics, as well as tracking of trends with respect to various components of water loss analysis
- Review alignment of these water loss management processes with industry guidelines and best practices
- Provide high-level objective observations on the existing water loss management analysis and initiatives, including coordination between the City and County with respect to water loss management

METHODOLOGY

Information used in this report was gathered from two interview sessions, one each with City staff and County staff. Additional clarifications and data were sought and obtained from the Water Analyzer Office and Office of Asset Management team after the interviews.

Data and information sources used for preparing this briefing and in the preparation of the interviews included:

- 2009 and 2010 water audit reports prepared by outside consultants for the City
- Unaccounted-for for water data for various years provided by County WAO
- FY 2010 to FY 2019 water production, consumption and unaccounted-for volume and percentages, provided by OAM
- Output report from OAM's FY 2019 AWWA water audit spreadsheet summary

The alignment of water loss management processes with industry guidelines and best practices was documented. Finally, high-level observations on the existing water loss management analysis and initiatives, including coordination between the City and County with respect to water loss management was developed.

SUMMARY OF CITY AND COUNTY PRACTICES

Exhibit 4-7. Summary of City and County Practices – Water Loss Management Programs

Element	City	County	Comments
Water Audit	▪ Annual water audits conducted using AWWA M36 software and methodology	▪ Annual water audits conducted using AWWA M36 software and methodology	▪ This function is performed by the City's Office of Asset Management. ▪ While water audit activities are jointly administered by both the City and
Performance Indicators	▪ Operational and financial indicators computed from AWWA software are used ▪ No indicators exist to track success of the annual water loss program	▪ Operational and financial indicators computed from AWWA software are used ▪ No indicators exist to track success of the annual water loss program	

Exhibit 4-7. Summary of City and County Practices – Water Loss Management Programs

Element	City	County	Comments
Water Loss Mitigation Programs	▪ Identified numerous programs being implemented to address water loss ▪ However, no dedicated projects resulted from prior water audits	▪ The County does not have a role in maintaining the distribution network ▪ As a result, no loss mitigation programs were identified for the County	the County, water loss mitigation programs are implemented by the City alone
Water Loss Reduction Roadmap	▪ No documentation of long-term water loss reduction plan and goals	▪ No documentation of long-term water loss reduction plan and goals	

Background

The Baltimore City Department of Public Works is responsible for the management and operation of water facilities. Within DPW, the Bureau of Water and Wastewater focuses on the production and distribution of treated drinking water, including respective maintenance functions. The Bureau manages the metering and billing of over 400,000 retail customers in Baltimore City, Baltimore County and wholesale accounts in Anne Arundel, Carroll, Harford and Howard Counties.

The Bureau of Water and Wastewater houses the OAM. Created in 2015, the OAM's primary responsibility is to optimize the service life of linear water infrastructure through the development and implementation of proactive condition assessment and maintenance programs. It implements a strategic approach to managing assets at a reduced lifecycle cost and an acceptable level of risk. The Office has three divisions: Planning and Analysis, Data Management and Preventative Maintenance. These divisions track and manage water loss for the distribution system comprising of over 4,000 miles of water mains (City and County service area).

Since its creation, the OAM also houses the WAO, which was created in 1972 pursuant to an agreement between Baltimore City and Baltimore County. The WAO was created to evaluate existing and future capacities of the Baltimore metropolitan water distribution system; per the agreement, the WAO was to be jointly staffed by both City and County engineers but is currently staffed only by County engineers who correspond with counterparts in the City by email. The WAO, in collaboration with OAM, tracks and monitors water production, consumption data and the water losses in the water distribution system.

Findings

Water Distribution System Overview

Baltimore's distribution system delivers around 200 MGD (actual FY 2019) of treated water to consumers throughout the metropolitan region. Its service area is approximately 560 square miles and supplies potable water to about 1.8 million residential as well as business consumers.

The system uses a network of water mains spanning over 4,500 miles (Baltimore City, Baltimore County and parts of Howard County and Anne Arundel County), ranging in size from 3 inches to 144 inches in diameter, to distribute water to customers. Many of these mains are constructed from cast iron, but some of the larger mains are steel or reinforced concrete. These mains connect a series of pumping stations, reservoirs and elevated storage tanks, which supply water to Baltimore City and parts of Baltimore County,

Howard and Anne Arundel Counties. Within the network of mains, five major pressure zones are maintained to provide adequate water pressure and supply to the consumers. Under the current operating system, Montebello Filtration Plant No. 1 and Montebello Filtration Plant No. 2 supply water to the First Zone by gravity, and the Second and Third Zones using pumping stations. The Ashburton Filtration Plant supplies water to the Second Zone by gravity and to the Third, Fourth and Fifth Zones using pumping stations.

Current Water Loss Management Process

The annual process begins after the end of the fiscal year, with the preparation of a water production report compiled by the WAO. This report documents the total volume of water produced and consumed in each pressure zone to calculate the total volume of unaccounted-for water. Production data are obtained from the treatment plants, and consumption data are obtained using billing and metering data.

Then, the AWWA *M36 Water Audits and Loss Control Programs* methodology and software are utilized to conduct a top-down water audit to determine both apparent losses and real losses. During instances where data required by the AWWA software is unavailable (for example, unbilled unmetered consumption), the default AWWA values or estimates are used.

At the conclusion of the audit, the findings are presented to various offices in DPW. It was communicated during the interviews that the WAO first began internally using the AWWA methodology and software in 2017 and has seen improvements in better accounting of real losses.

Data Capture

Collection and management of water production and consumption data in the City and County are performed by Baltimore City DPW. DPW utilizes the following data capture methods and tools:

UMAX

In 2016, the City replaced a legacy customer information system (CIS) with a modern utility customer information system called UMAX (developed by Itineris) to manage its customer accounts and billing. The deployment of UMAX enabled the City to retire the “minimum bill” model, which charged water customers a minimum usage fee and implemented billing based on actual consumption. In contrast, as of this report’s writing, the County’s customer accounts and billing are still on the legacy customer information system. The County’s customer accounts are expected to be transitioned to UMAX at a future date. The billing data obtained from UMAX and the legacy system are used by the WAO, reconciled for discrepancies and used in preparing the water production report and in the AWWA water audit software program.

Automatic Meter Reading or Advanced Meter Infrastructure (AMR/AMI)

Water consumption data for City and County customers is collected wirelessly through automatic meter reading using meters installed within the last five years. Through integration with UMAX, all City accounts are metered on a real-time basis and billed monthly. For County customers, metering data is collected wirelessly on a quarterly basis.

Telemetry and Data Logging (Telog)

With respect to production and wholesale meters, DPW utilizes remote monitoring through Telog to capture water flow data.

Water Management Information System (WMIS)

DPW maintains WMIS, an in-house excel spreadsheet, to analyze and monitor flow data in the distribution system. WMIS is used to produce the annual water production report.

Data Validation and Analysis

All consumption and production data are checked by OAM engineers. Some error and validation checks (including real-time error corrections) on the City's billing data are applied using the built-in features of the UMAX system. OAM obtains billing data from the DPW Office of Information Technology. In instances where accounting and billing adjustments are made, OAM personnel make appropriate adjustments to water consumption data to accurately capture the consumption volume.

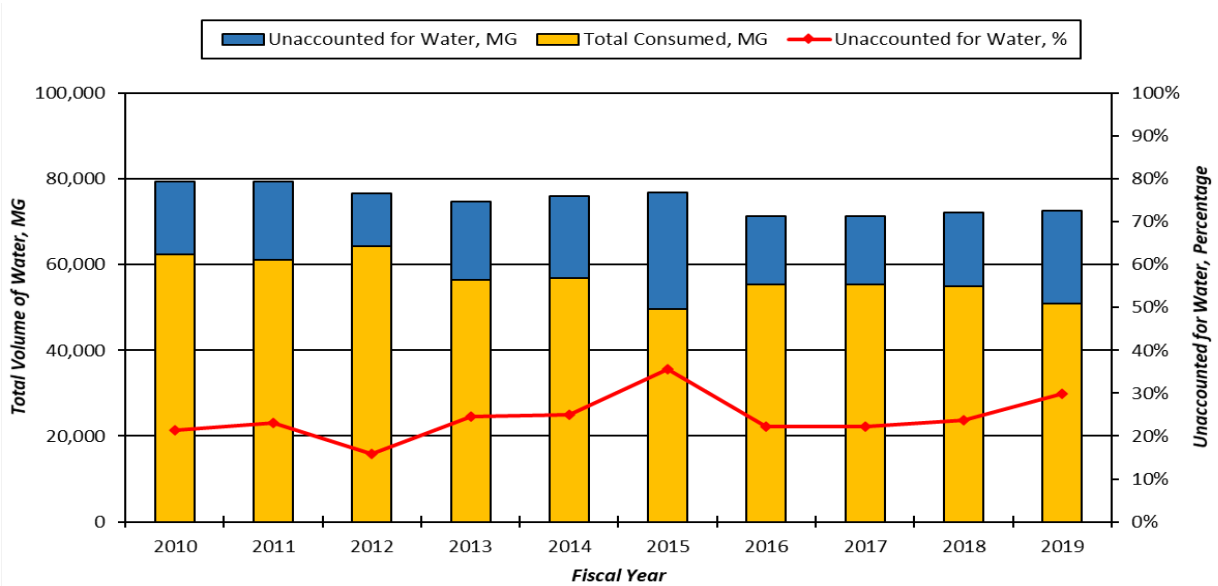
Accounting for metering inaccuracies is done on an individual account basis using the age of meters, based on the assumption that older meters are less accurate than newer meters. It is important to note that meters in the City have been recently replaced and are five years old or less.

It was communicated that on occasion, the water loss report is evaluated by the City's Auditor's Office with feedback provided to DPW. As mentioned previously, the water loss report is also presented to various offices within DPW for feedback.

Tracking of Trends

The OAM tracks unaccounted-for water for DPW's water distribution system on a fiscal year basis. Unaccounted-for water is calculated as a difference between the total water produced and the total water consumed in million gallons. The percentage of unaccounted-for water for DPW is presented in the exhibit below.

Exhibit 4-8. Summary of DPW's Water Produced, Consumed and Unaccounted-For from FY 2010 to FY 2019



Source: Office of Asset Management, October 2020

From FY 2010 through FY 2019, unaccounted-for water in the distribution system varied from 16.0% to 35.5%. Since OAM started conducting water audits in FY 2017, unaccounted-for water in the distribution system varied from 21.8% (FY 2017) to 29.8% (FY 2019). This 8% increase in trend as well as observed

fluctuations may be illustrative of current shortcomings in water loss management efforts. Unaccounted-for water data for FY 2020 was not available at the time of this reporting.

Best Practices

Water loss management efforts currently undertaken by OAM were compared to industry best practices under the following practice areas:

- Water audit
- Performance indicators
- Water loss mitigation programs
- Water loss reduction roadmap

Water Audit

Water loss in distribution systems causes a significant loss of revenue to utilities, negatively impacts customer service levels and wastes a critical natural resource. According to EPA's estimates[4], up to 75% of water lost in distribution networks is recoverable. Performing a water audit is the mechanism with which water utilities achieve the accurate accounting of water produced, delivered to their customers and both real[5] and apparent[6] losses within the system. Best management practice for water utilities dictates conducting annual water audits through careful examination of supplied water flow data and customer billing records.

Water loss management programs across the country have implemented water audits to varying levels of maturity. AWWA's 2016 *The State of Water Loss Control in Drinking Water Utilities* white paper categorizes the maturity level of each state's water loss management policies as one of the following:

- No water loss reporting
- Rudimentary water loss reporting
- AWWA M36 terminology and metrics
- AWWA M36 software
- AWWA M36 software with validation (Level 1)

DPW's current practices fall under the category of using the AWWA M36 software and methodology. To that end, DPW is demonstrating alignment with industry best practices.

Performance Indicators

Measurement of performance is fundamental to the administration of any water loss program, project or activity. It serves many purposes, from helping to understand the value of a water loss mitigation effort input into a water loss control process (through the usefulness of the process itself) to providing information necessary to improve the process.

OAM computes operational and financial performance indicators using AWWA's audit software (version 5.0) to evaluate water losses. These performance indicators, along with outputs from the most recent water audit (FY 2019), are provided in the following exhibit.

[4] "Water Audits and Water Loss Control for Public Water Systems", EPA, July 2013.

[5] Real losses are incurred due to infrastructure leakage and breakage, which result in actual loss of water from distribution networks.

[6] Apparent losses are a result of inaccuracies in metering and billing, unauthorized consumption and systematic data handling.

Exhibit 4-9. List of Performance Indicators

Performance Indicator Type	Performance Indicator	Units	Value from Last Available Water Audit (using AWWA software)
Financial	Non-revenue water as percent by volume of water supplied	%	20
	Non-revenue water as percent by cost of operating system	%	16.7
	Annual cost of apparent losses	$	15,087,978
	Annual cost of real losses	$	31,897,858
Operational	Apparent losses per service connection per day	gallons/connection/day	21.34
	Real losses per service connection per day	gallons/connection/day	59.16
	Real losses per length of main per day		N/A
	Real losses per service connection per day per PSI pressure	gallons/connection/day/PSI	0.94
	Unavoidable Annual Real Losses (UARL)	million gallons/year	2,751.50
	Current Annual Real Losses (CARL)	million gallons/year	8,739.14
	Infrastructure Leakage Index (ILI)	CARL/UARL	3.18

Source: Office of Asset Management, October 2020

OAM also relies on the annual water production report and the percentage of unaccounted-for water reported to monitor water losses within its system. It was indicated that a 25% (of the production volume) target is used for unaccounted-for water in the distribution system. No other performance indicators currently exist for measuring the impacts of water loss mitigation and control efforts undertaken by DPW.

Water Loss Mitigation Programs

Once an audit is completed and both apparent and real losses have been identified, implementation of water loss mitigation activities should commence in order to reduce the identified losses and sources. DPW implements a variety of programs that reduce water loss and improve the accuracy of metering data in the distribution system. These programs are described below.

Meter Testing and Replacement

Through a proactive meter testing program, accuracy tests are conducted on all production and wholesale meters annually. The distribution system contains approximately 51 master meters. Master meters are defined as meters measuring flow entering the distribution system from the production plants, leaving the system via County wholesale meters and those located at pumping stations measuring the transfer of water from one zone to another. The distribution system has six production meters, 13 wholesale meters and 32 meters located at active pump stations.

DPW has an active meter testing and calibration program for production meters in its distribution system. The frequency of testing and calibration is based on the size of the production meters. Following a 2010 external water audit, concerted efforts were made to improve the quality of production data capture.

Within the last five years, in line with AWWA M36, DPW undertook the implementation of a complete AMR/AMI system for residential and commercial customer meters.

These undertakings are expected to reduce apparent water loss resulting from meter reading errors.

Leak Detection and Distribution System Upgrades

DPW has several programs for addressing real losses in the distribution system. The programs are:

Leak Detection Program

DPW utilizes leak detection technologies such as *Smartball*. DPW also deploys crews to conduct leak surveys throughout the year and identify leakage within its distribution system, with repairs performed as needed.

Water main Replacement Program

This is a program that replaces 15-miles of critical water mains each year on a fiscal year basis. To identify and prioritize the replacement of critical water mains, the OAM utilizes a risk-based asset management approach. With the replacement of each critical main, DPW reduces leakage and the likelihood of water loss within its system.

Prestressed Concrete Cylinder Pipe (PCCP) Inspection Program

This is a condition assessment program that inspects and replaces critical segments of PCCP within the distribution system.

Water Loss Reduction Roadmap

Having medium- and long-term plans to tackle water loss demonstrates a vigilant commitment by a water utility. Often utilities find it helpful to reduce water loss by establishing a multi-year water loss reduction roadmap. The roadmap may include approaches to assess water loss in further detail, identify data gaps and develop data gathering tools to better quantify losses.

Industry best practice recommends the development and implementation of a long-term water loss reduction plan. However, there is no documentation of a long-term water loss reduction plan. No separate or independent water loss program is implemented by the County or on behalf of the County or specific to the portion of the distribution system under the jurisdiction of the County (note that maintenance of almost all of the water distribution system in the County is the responsibility of the City, not the County).

High-Level Observations

Below are high-level observations on the existing water loss management analysis and initiatives, including coordination between the City and County with respect to managing water loss in the distribution system.

City and County Coordination

OAM currently manages water loss programs for the City and County, working in concert with WAO, which was intended to be jointly staffed by City and County personnel but is currently only staffed by the County. There is no clear delineation of roles and responsibilities between City and County entities as they pertain to water loss management efforts.

Program Status

Consistent use of industry-based methodology and tools (AWWA M36) by OAM began in 2017. The current water loss program consists of conducting an internal audit and data validation. It is not benchmarked against peer utilities or certified by external auditors (such as Level 1 validators). No

proactive efforts exist for systematically identifying the sources of water loss. The current water loss program is in its infancy.

Program Outlook/Roadmap

No specific long-term water loss reduction plan exists. However, OAM and DPW are making efforts to improve data capture, quality and analysis to address apparent losses while also making appropriate infrastructure repairs and upgrades that are expected to reduce real losses.

Performance Indicators and Benchmarks

OAM's current performance measure of unaccounted-for water (with an internal threshold of 25% of total production) does not fully capture all aspects of a comprehensive water loss management program. It fails to adequately account for real and apparent losses, particularly in terms of water and revenue loss. With the adoption of the AWWA methodology, DPW expects to support the continuous improvement and efficiency of the various water loss mitigation and control efforts.

Accounting of Revenue Loss

There is a gap in fully capturing and realizing the significant financial impact of water loss within the distribution system.

With respect to water loss management efforts, OAM is primarily focused on meeting operational needs, such as estimating the volume of unaccounted-for water and conducting water audits. While the water audit report and its findings are shared with other stakeholders, there is no indication that the results are used to initiate efforts that reduce water loss in the distribution system.

Data Governance

While OAM's water audit software and supporting files are stored and used according to DPW's information technology standard operating procedures, manual corrections and adjustments made to consumption and production data lack formal documentation. This impedes retroactive reviews and data validation efforts.

Task 4.3 Drought Response Planning

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review and summarize the overall drought response management planning processes and initiative and inter-governmental coordination
- Provide high-level objective observations

Methodology

The methodology of this evaluation consisted of a review of relevant documents, followed by interviews with staff whose responsibilities covered areas under review, and an assessment of this information based on standards and industry best practices. The documents reviewed included:

Provided by the City

- Maryland Statewide Water Conservation Advisory Committee, Final Report November 2000
- Susquehanna River Basin Commission Docket No.20010801, August 9, 2001
- Susquehanna River Basin Commission Docket No.20010801.1, September 15, 2001
- "Stop the Drop and Endure the Drought," August 20, 2002 presentation slides
- Drought Data Report (Baltimore City), March 5, 2003
- "Drought Management Using Streamflow Forecasts: A Case Study of the City of Baltimore Water Supply" (May 26, 2016 journal submission)
- Baltimore City "Core" Water Supply System Operating Plan, August 2000 (draft)
- Baltimore City DPW organizational chart

Provided by the County

- Baltimore City "Core" Water Supply System Operating Plan, August 2000 (draft)
- Baltimore City Water Conservation Plan

Items sourced independently

- Susquehanna River Basin Drought Coordination Plan; Publication 212, August 2010
- "Maryland Drought Information and Current Status" from the MDE website (https://mde.maryland.gov/programs/Water/droughtinformation/Pages/index.aspx), last viewed November 12, 2020
- Maryland Statewide Water Conservation Advisory Committee, Final Report, November 2000 ("Drought Report")
- Planning and Drought, American Planning Association Planning Advisory Service Report No. 574
- Use and Effectiveness of Municipal Water Restrictions during Drought in Colorado, Kenney D. et al. Journal of The American Water Resources Association, February 2004
- Drought Preparedness Planning: Building Institutional Capacity, Wilhite D. et al., Ch5 from Drought and Water Crises: Science Technology, and Management Issues (CRC press 2005) available from https://drought.unl.edu

Summary of City and County Practices

Exhibit 4-10. Summary of City and County Practices – Drought Response Planning

Element	City	County	Comments
Coordination	▪ The City's responsibility related to drought response is limited to enforcing usage violations	▪ The County's responsibility related to drought response is limited to enforcing usage violations	▪ The State of Maryland determines drought conditions, sets response actions/limits and authorizes local enforcement of usage violations
Documentation	▪ An official plan is needed ▪ An RFP for a comprehensive watershed plan, including a drought management component, has been issued	▪ An official plan is needed	▪ The State has a current plan, while the County and City both need coordinated plans ▪ The Susquehanna River Basin has a drought plan, but there is limited overlap and impact to the City and County

Findings

The City has robust and reliable sources for drinking water, including three reservoirs and a withdrawal allotment from the Susquehanna River. City staff reported rarely needing to use the Susquehanna River allotment as a backup to reservoir supplies. According to City staff, the 2002/2003 event was the last time this may have been done, and the river withdrawal was sufficient to meet demand at that time.

A drought management plan specific to the City may have previously existed, but no such document was able to be provided by City staff during this report investigation. The November 2000 "Maryland State Water Conservation Advisory Committee, Final Report" does lay out a suggested plan and triennial review schedule. Currently, the State has an active drought program and plan in place under the responsibility of the MDE. The MDE determines drought conditions and sets use restrictions. When in effect, State Executive Order 0.12002.04 authorizes both State and local law enforcement to enforce use restrictions. The MDE has provided guidance suggesting enforcement protocols.

The City provided a 2016 draft article for journal publication that discussed an alternative approach to predicting drought demand. The method presented uses stream flow forecasting to project "days of remaining storage" for a given reservoir asset. At the time of the interview, City staff were uncertain of the status of this discussion, and the days of remaining storage method was not currently in use. It is unclear how adopting the method would be coordinated with MDE responsibilities during drought conditions.

The Maryland Statewide Water Conservation Advisory Committee: Final Report, November 2000 recommendation #6 suggests implementing a rate structure that promotes conservation and efficiency. Although this report deals with water shortages and use, in general, it has a significant focus on drought-related issues. The recommendation to consider alternative rate structures is not specifically targeted at drought condition demand reduction.

BEST PRACTICES

Neither City nor County staff were able to provide plan documents covering drought management. The State of Maryland has a current plan, which was not specifically evaluated as part of this report.

The National Drought Mitigation Center at the University of Nebraska classifies plans into two basic types: mitigation plans and response plans. Mitigation plans focus on actions taken in advance of drought conditions to reduce the impacts during droughts. Response plans describe activities that take place at the onset of emerging drought conditions and during active drought conditions. The American Planning Association (APA) "Planning and Drought" guidance report states that if a drought plan is standalone, it should "incorporate both mitigation and response." Although not likely to be standalone, a plan developed for the City or County should consider elements of both mitigation and response items. Relevant authority and jurisdiction will be distributed, so a standalone plan that is limited to one party's responsibilities could be conceivable. Preemptive actions should be considered, and the overlaying nature of official jurisdiction on a regional watershed will require coordination of responsibilities.

AWWA's *M60 Drought Preparedness and Response* describes the development and implementation of a drought plan. Seven steps are listed in the process described:

1. Form a water shortage response team
2. Forecast supply in relation to demand
3. Balance supply and demand and assess mitigation options
4. Establish triggering levels
5. Develop a staged demand-reduction program
6. Adopt the plan
7. Implement the plan

AWWA also hosts a drought resource community with access to numerous materials.

A similar process is defined in Wilhite's Drought Preparedness Planning: Building Institutional Capacity, with ten steps:

1. Appoint a drought task force
2. State the purpose and objectives of the drought preparedness plan
3. Seek stakeholder participation and resolve conflict
4. Inventory resources and identify groups at risk
5. Prepare/write the drought preparedness plan
6. Identify research needs and fill institutional gaps
7. Integrate science and policy
8. Publicize the drought preparedness plan and build public awareness
9. Develop educational programs
10. Evaluate and revise the drought preparedness plan

The guides for each of these processes have detailed guidelines and suggestions. The AWWA approach includes examples of tailoring and modifying plans to accommodate unanticipated circumstances and includes more of a consideration for regulatory compliance. The Wilhite process emphasizes a hazard mitigation approach, with flexible guidelines that also anticipate changing conditions.

Managing demand during times of drought conditions is often the most significant challenge in managing droughts. Mandatory restrictions have been shown to be more effective than voluntary measures, but all approaches require significant public outreach (Kenney et al. 2004). Streamlining these restriction programs and coordinating across different communities was found to be a challenge. For this reason,

increased effectiveness of outreach efforts and stakeholder engagement was identified as a significant need following this study (Kenney et al. 2004).

High-Level Observations

Historically drought conditions have been infrequent in the State of Maryland. As such, this subject area receives less attention from City and County officials. Anticipatory drought planning can help ensure that water quality in the reservoirs is maintained and not allowed to degrade. The areas found by this report investigation to be most in need of further consideration are as follows.

As the main supplier in the region, the City should establish formal drought monitoring and response documentation. This may not require independent and comprehensive plans where coordination and protocol identification will be sufficient.

The authority to enforce drought condition restrictions is clearly defined, but monitoring and evaluating the effectiveness of these measures is not well known at the time of this report investigation.

Significant drought events occurred in the mid-1960s, in 1998 and again from 2002 to 2003. Although not common, these have been severe enough to justify developing formal plans or more formalized protocols to coordinate with the State plan and programs. The 2002 Water Advisory Committee report suggests that water suppliers develop conservation programs and review rate programs (page 4, recommendation #6). A robust drought monitoring and response program is in use at the State level. Additionally, the Susquehanna River Basin Commission (SRBC) has developed a plan (2000). The intent of the plan is primarily to facilitate coordination, but the Commission does have the authority to declare emergency status and modify allotments during drought conditions. Only Harford and Cecil Counties have significant land area within the Susquehanna drainage basin.

There has been consideration at different times to evaluate using the river withdrawal allotment more frequently and in advance of drought condition drawdowns. River withdrawals (SRBC docket) represent a substantial quantity of available water but provide this volume at an increased cost (both conveyance and additional treatment required). It may appear desirable to utilize Susquehanna water in advance of severe drought conditions to maintain reservoir elevations during droughts and thereby mitigate drawdowns. City staff determined that the additional expenses (additional pumping and treatment) were too great to justify this option (Baltimore City “Core” Water Supply System Operating Plan, 2000). Reductions in reservoir water quality have been observed by City staff during extreme low water periods as the hydromorphology of source streams generates increased turbidity, and this remains a potential concern.

A variable pricing structure has been used by some county bulk purchasers with higher rates during higher demand times of the calendar year (summer). It is our understanding that no pricing structure specific to drought response demand management has been used. Carefully designed rate structures have been demonstrated to be highly successful in reducing usage while stabilizing O&M budgets across periods of variable use and fees. While these approaches have reduced baseline demand, a 2019 study by the University of North Carolina-Chapel Hill Environmental Finance Center on water pricing across California during recent drought conditions indicated that while pricing showed evidence of reducing base demand, during a drought, users are already efficient in their consumption and tend not to be sensitive to price signals. The study further stated that "One of the most successful strategies appeared to be strict local enforcement of conservation directives by issuing warnings to customers that violated them. Agencies that issued more warnings per 1,000 customers achieved, on average, a greater level of water savings than other agencies."

TASK 4.4 SAFETY PROGRAMS AND RISK MITIGATION PLANNING

SCOPE

The project team was requested to perform the following scope of services for this subtask:

- Review and summarize the overall safety programs with respect to water and sewer services in the City and County and any associated joint City-County planning and initiatives
- Provide high-level observations on industry best practices

METHODOLOGY

A comprehensive request for information and data was provided to the City and County as a first step in the analysis. Interviews were planned and conducted with City and County safety staff and utility operations leadership. A comprehensive request for information and data was provided to the City and County as a first step in the analysis. The project team plan included investigating current and historical safety staffing, the current and historical safety budget, the adequacy of safety procedures, COVID-19 impacts, the effectiveness of safety training and the overall success of the safety program implementation. In addition, plans were made to identify any joint City and County safety planning initiatives. Field interviews were planned but could not be conducted due to COVID-19. Thus, a series of telephone interviews and emails were conducted throughout the study with management personnel and risk and safety staff to help define the parameters of the water and sewer safety and risk program. A questionnaire focused on safety program implementation along with training and safety program effectiveness was developed and distributed to key City and County staff, including directors, chiefs, Bureau of Risk Management/Division of Occupational Safety, Office of Safety and Training (OST), County Safety Office professionals and County Bureau of Utilities superintendents and other leaders. The data was assessed in accordance with Occupational Safety and Health Administration (OSHA) core elements of Recommended Practices for Safety and Health Programs.

Our workplan also included the development of a list of best practices and a comparison of the City and County safety and risk mitigation programs to these best practices. The workplan also included the development of high-level observations of City and County practices relative to best practices. Sources of best practices and references used by the project team included the following:

- AHA (American Heart Association)
- AWWA *M3 Safety Management for Utilities*
- CDC (Centers for Disease Control and Prevention)
- EPA (United States Environmental Protection Agency)
- Maryland Division of Labor and Industry approved plans
- OSHA Recommended Practices for Safety and Health Programs in Construction Oct 2016
- OSHA Construction Industry 29 CFR 1910 General Duty Clause
- OSHA Construction Industry 29 CFR 1926 Construction
- The Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat.1590 et seq. 29 U.S.C. 651 et seq). U.S. Department of Labor Region 3
- NFPA (National Fire Protection Association)
- NIOSH (National Institute for Occupational Safety and Health)
- The City of Baltimore Standard [Design and Construction] Specifications 2006 (also known as the "Green Book")

Our review is a high-level review, and the findings and best practices outlined in our report are based on the information and data provided by Baltimore City and Baltimore County.

Summary of City and County Practices

Exhibit 4-11. Summary of City and County Practices - Safety Programs and Risk Mitigation Planning

OSHA Core Elements of an Effective Safety Program	City	County
Organizational Structure	▪ Incident at the Patapsco Wastewater Treatment Plant resulted in restructuring ▪ Director role sets Bureau direction ▪ Managers at all levels have inadequate support for program ▪ 22 volunteer safety coordinators at field locations, more assistance is needed as this is not their only task	▪ Safety program recently restructured ▪ Safety responsibilities are untraditional relative to OSHA recommendations ▪ Field supervisors concerned with new structure
Management Leadership	▪ Top management, directors, division chiefs, the safety office and the risk management office indicate commitment to workplace safety and health and the goals set forth by the Office of Safety and Training (OST) and the risk management office	▪ Senior County executive not responsible for employee safety ▪ Lack of safety goals from top management ▪ Safety roles and responsibilities are unclear ▪ Update of safety manual is positive
Worker Participation	▪ Training provided as needed by internal OSHA approved instructors ▪ All workers are properly trained in safe work practices guidelines ▪ Reporting of hazards, investigating and tracking incidents and risk management encouraged	▪ Employees appear to understand their role in safety ▪ Employee safety coordinators committee exists ▪ Employees not involved in all aspects of the safety program
Hazard Identification and Assessment	▪ OST and risk management procedures used to continually identify hazards and evaluate risk ▪ Safety coordinators report emergencies to managers ▪ Risk management office and OST investigates all incidents	▪ Significant role delegated to department heads ▪ Supervisors feel hazard identification training needs improvement
Hazard Prevention and Control	▪ Management reports cooperation with the safety office to reduce risk per OSHA guidelines ▪ Safety and health plan helps ensure controls are implemented and progress tracked	▪ Responsibilities for workplace monitoring and exposure testing is unclear ▪ OSHA hierarchy of controls should be an integral part of the safety manual
Education and Training	▪ OSHA approved trainers provide all workers with training in house ▪ If training cannot be scheduled in-house, it is provided by outside sources ▪ Employers, managers, supervisors and coordinators receive training on OSHA requirements	▪ Supervisors believe safety training needs improvement ▪ No central safety training tracking system ▪ Safety trainers attend courses not independently certified

Exhibit 4-11. Summary of City and County Practices - Safety Programs and Risk Mitigation Planning

OSHA Core Elements of an Effective Safety Program	City	County
Program Evaluation and Improvement	▪ Some employees' report safety deficiencies need to be addressed and assessed ▪ Safety committee minutes and reports need to be standardized ▪ With annual change of volunteer Safety coordinators, there is a lack of consistency, oversight and compliance ▪ Digitization of various manuals, job safety reports and records are a work in progress	▪ No regular process to evaluate safety program and require improvements ▪ No written commitment to continuous improvement ▪ Safety policy lacks commitment to best practices ▪ Only four field inspections by safety professionals were conducted for Utilities in FY 2019
Communications and Coordination with Contract Employees and Outside Contractors	▪ The "Green Book" safety and health protection levels and reporting are mandatory with all contractors ▪ There is no formal joint safety coordination with the County	▪ County safety manual fails to articulate the benefits of regulatory partnerships ▪ Lack of communications with the City and no joint safety initiatives ▪ No contractor safety program
Response to COVID - 19	▪ Prior to COVID-19, the City did not have a pandemic emergency plan ▪ The Mayor's Office provides COVID-19 guidance based on CDC guidelines ▪ City response to COVID-19 is commendable	▪ County response to COVID-19 is commendable

Findings and Best Practices

OSHA recently updated its Guidelines for Safety and Health Programs. First released 30 years ago, the updated Guidelines reflect changes in the economy, workplaces and evolving safety and health issues. The new Core Elements of an Effective Safety Program have been well received by a wide variety of stakeholders. The recommendations present a step-by-step approach to implementing an effective safety and health program, built around seven core elements that make up a successful program:

1. Management Leadership
2. Worker Participation
3. Hazard Identification and Assessment
4. Hazards Control and Prevention
5. Education and Training
6. Program Evaluation and Improvements
7. Communication and Coordination

As part of our analysis, the project team added Organizational Structure and COVID-19 Response to the OSHA core elements due to their relevance in today's employee safety environment.

The main goal of safety and health programs is to prevent workplace injuries, illnesses and deaths, as well as the suffering and financial hardship these events can cause for workers, their families and employers. The recommended practices use a proactive approach to managing workplace safety and health. The recommended practices recognize that finding and fixing hazards before they cause injury or illness is the most effective method to protect employee safety and health.

Baltimore City

Baltimore City appears committed to implementing an effective safety program. While the program has a number of significant strengths, additional leadership/professional resources and organizational streamlining would aid program effectiveness. In addition, the City would benefit by implementing clearer safety policies/procedures and by providing training on best practices.

Some benefits of effective safety programs have been identified as follows:

- **Prevent/reduce** workplace injuries and illnesses
- **Improve** compliance with laws and regulations
- **Reduce** costs, including significant reductions in workers' compensation premiums
- **Engage** workers
- **Enhance** their social responsibility goals
- **Increase** productivity and enhance overall organizational success

Findings

Interviews indicate that Baltimore City management provides the leadership, vision and resources needed to implement an effective safety and health program.

The safety program was originally under the Water and Wastewater Bureau. In late 2019, the program was restructured to report directly to the Director of DPW. The Director's role is to set the direction through a clearly communicated safety and providing daily oversight of the effectiveness of the safety program.

DPW's Office of Safety and Training (OST) is charged with overall safety leadership throughout the Department, including the Water & Wastewater Bureau. OST conducts random audits of facilities to ensure that facility safety hazards are pointed out and addressed. The Office also responds to locations where City employees have been involved in vehicle incidents or accidents. Finally, in the event of a workplace accident or incident, OST is part of the incident investigation.

Each water and wastewater facility has a "safety coordinator," an employee who is the focal point of the facility safety program. The coordinators are volunteers who served a limited term and report to their location supervisors/managers; however, coordination of some safety-related activities is handled through the OST.

Interviews indicate that OST is fully committed to eliminating hazards, protecting workers and continuously improving workplace safety and health. OST's goal is to visibly demonstrate and communicate their safety and health commitment to workers and others and sets an example through their own actions.

Best Practices

Communicate Baltimore City's Commitment to a Safety and Health Program

While Baltimore City did not provide a written policy for safety and health for our review, it was reported that one exists and that all employees sign a document indicating they understand the policy. Input indicates that the City is working on developing a more clear, written policy that will help communicate that safety and health is a primary organizational value – as important as productivity, profitability, product/service quality and customer satisfaction.

As described by the Directors, there is no direct working relationship between the City and County on safety matters. This was reported to be the case both in terms of formal communication processes and operations.

The City's Office of Risk Management & Division of Safety has oversight of documents, and the safety coordinators can reach out to this office for copies (e.g., pump station confined space entry standards).

The Office of Risk Management & Division of Safety informs the Office of Safety and Training of any significant operational changes. The City's Administrative Manual (AM) is the primary source document utilized by the Office of Safety and Training.

Safety enforcement officers are provided throughout the City and as needed. They perform hazard assessment or analyses, accident investigations, injuries, complaints and field visits. The Office of Safety and Training serves as the liaison between DPW and the Office of Risk Management & Division of Safety on all safety issues. Safety statistics are tracked and addressed by a claims handler under workers' compensation. The Office was unable to provide important safety statistical data commonly used to manage and/or assess the effectiveness of a safety program. The data requested but not received from the City includes the following industry metrics:

- Emergency response readiness training
- Health and safety severity rate
- Recordable incidents rate
- Number of near misses rate
- Insurance claims (claims/200,000 hours worked)
- Severity of insurance claims ($/200,000 hours worked)
- Average severity ($/claim)

The Office of Risk Management & Division of Safety uses forms to generate documentation [e.g., Maryland Occupational Safety and Health (MOSH)]. Training for defensive driving is provided by the office. If additional training is required (e.g., Water Sampling under the Americans with Disabilities Act), it would be contracted out to the National Safety Council (NSC) or provided in-house, depending on the type of training.

The Office of Risk Management & Division of Safety also provides a review of capital improvement project design and construction proposals upon request while providing feedback as needed.

OST's training officers are certified OSHA instructors by the Chesapeake Region Safety Council (CRSC). The Office of Safety and Training is authorized to provide OSHA training in the following areas: certification for OSHA 30, OSHA 10, confined space and trenching and excavation. Copies of certificates are maintained on-site, and training information is maintained in the OST's training database. All DPW safety coordinators are trained in OSHA 30.

OST training staff spend 90% of their time providing training to employees in various training areas in DPW. The OST conducts evaluations and implements a driving improvement program (DIP), which was implemented approximately four years ago. Other training includes, but is not limited to:

- Basic defensive driving certification and defensive driving recertification training for DPW and the Department of General Services (DGS) are provided. Commercial driver license (CDL) skills training is provided for all CDL holders. Advanced driving training is also provided for eligible CDL holders to upgrade their licenses to Class B CDL.
- Work zone safety, traffic control training and move over laws are addressed in driving programs.
- Vehicle snow removal and skills/range training are offered for DPW, BCDOT (Baltimore City Department of Transportation) and DGS employees.
- CPR/first aid training and required renewal training after two years. This training is offered to employees by the OST at least twice per month.
- Training on fire extinguishers (and other safety equipment maintained in vehicles) in the OSHA 10 and 30 training classes are offered.

- To meet industry standards for electrical safety, electricians are provided electrocution hazards, NFPA 70E and arc flash classes.
- "Toolbox safety monthly talks" are performed, with instructions expected to be conducted by field supervisors.
- Additional training includes the fundamentals for supervisors; slips, trips and falls; forklift training; proper lifting; operating hand tools; LOTO (lockout/tagout); HAZCOM (hazard communication standards), etc.

Safety deficiencies are filed through the safety component of the OST and are tracked and addressed accordingly.

DPW maintains a professional working relationship with outside agencies such as MOSH and OSHA regarding safety matters, including compliance issues.

The City's Emergency Operations Center (EOC) sends "emergency alert messages" to alert City employees of emergencies and imminent safety/health-related issues. Safety staff is on call at all times to respond to calls.

All specialized training (e.g., certification training for utility maintenance) for employees in the areas of collections and distribution, CCTV and pipelines may be provided by an outside vendor such as NASSCO (National Association of Sewer Service Companies).

Provide a Written Safety Policy

OSHA guidelines include establishing a written policy signed by top management describing the organization's commitment to safety and health and pledging to establish and maintain a safety and health program for all workers. Components are to include:

- Communicate the policy to all workers and, at appropriate times and places, to relevant parties.
- Reinforce management commitment by considering safety and health in all business decisions, including contractor and vendor selection, purchasing and facility design and modification.
- Be visible in operations and set an example by following the same safety procedures you expect workers to follow. Begin work meetings with a discussion or review of safety and health indicators and any outstanding safety items on a "to-do" list.

The Bureau of Engineering and Construction within DPW adheres to written policies regarding health and safety that are incorporated into the "Green Book," which provides all stakeholders with design and construction guidelines. Contractors must submit written health and safety plans prior to construction, which are reviewed internally by the Bureau of Risk Management/Division of Occupational Safety. Interviews indicate that City management's commitment to the City of Baltimore safety program is reinforced through the Office of Risk Management & Division of Safety and its continuing expansion of the Office of Safety and Training's programs to meet the growing needs of the Department of Public Works, other City agencies and the citizens of Baltimore.

Prior to COVID-19, it does not appear the City had an emergency plan related specifically to pandemics. Since COVID-19, the City has developed and implemented a comprehensive plan within the Baltimore City Health Department. Managers stated that COVID-19 has been a "game-changer" in that employees have had to adjust not only their personal lives but also their day-to-day routines. Following COVID-19 guidance from the Mayor's Office, the City has adjusted staffing, modified shifts and established protocols to ensure the safety of personnel. In general, the City has been able to get buy-in from personnel about the importance of following guidelines. With the focus on COVID-19, the City suspended safety observations, inspections and toolbox meetings. The City is now in the process of reviving them through various online meeting platforms.

Define Program Objectives and Goals

OSHA guidelines include establishing specific goals and objectives and setting expectations for managers, supervisors and employees. The goals and objectives should focus on specific actions that will improve workplace safety and health. At this time, the City has not fully met the best practice to establish, implement and enforce safety program objectives and goals across the DPW.

From a performance perspective, the nature of utility work requires employees to perform tasks with inherent safety risks. The City had a death at one of its facilities in 2019. We were told during our interviews that tragedy led to a redoubling of efforts to engender a safety culture in everyone.

The Department of Public Works' Communications Office pushes out general "safety alerts" for the Department in coordination with the Office of Safety and Training.

City staff expressed the view that more staff were required, especially to fill the Safety Coordinator roles in various departments with bona fide safety professionals. The City is in the process of creating positions for bona fide safety professionals that can be dedicated to each of the divisions. Since their purview is City-wide and all City agencies, OST needs additional personnel.

It is a best practice to establish realistic, measurable goals for improving safety and health. Goals focusing upon injury and illness prevention should be included rather than solely focusing on injury and illness rates. Plans to achieve the goals by assigning tasks and responsibilities to particular people, setting timeframes and determining resource needs are also needed. The City maintains information and works with the Department of Health, CitiStat and the Department of Human Resources, although staff interviewed did not provide information about CitiStat as the tool that captures and tracks risk.

Allocate Resources

OSHA guidelines include management providing the resources needed to implement the safety and health program, pursue program goals and address program shortcomings when they are identified.

The safety coordinators communicate directly with the management structure at the facility they help to oversee. In general, communication is good. A clear policy is needed that defines the responsibilities of the safety coordinator to report safety issues or concerns beyond the local management level. The policy would also achieve consistency in how safety coordinators document their communications and ensure top management can take action if necessary.

Employees understand the critical role they play in maintaining a safe workplace. However, interviews indicate that all employees do not necessarily act on that knowledge. Baltimore City has recently added a compliance position that reports directly to the Bureau head. Through this position, the City seeks to implement a consistent accountability framework that will hopefully help employees better assume their responsibility for helping ensure a safe workplace.

Best practices include the following:

- Estimate the resources needed to establish and implement the program
- Allow time in workers' schedules for them to fully participate in the program
- Integrate safety and health into planning and budgeting processes and align budgets with program needs
- Provide and direct resources to operate and maintain the program, meet safety and health commitments, and pursue program goals

While it was reported that the City offers contact tracing efforts, daily monitoring and screening protocols, awareness messages, OSHA inspections and safety seminars, information about these best practice programs was not provided to the project team.

Office of Compliance and Research

There are two laboratory sections in the DPW, consisting of four labs as follows: water quality labs at the Montebello and Ashburton water filtration plants and environmental labs at the Back River and Patapsco wastewater treatment plants.

Maryland does not have a certification program for environmental labs. The City Compliance Office is working towards acquiring national certification under ISO/IEC 17025 by FY 2023. The water quality labs are certified by MDE. No violations have been found. The next audit was scheduled for this spring but was postponed due to COVID-19.

The City has recently updated its comprehensive chemical hygiene plan (CHP), but it is not yet final.

Each lab section is currently updating its quality assurance manuals.

Records of lab staff skills are maintained on-site by the respective lab section chiefs.

Each lab test performed has a technical lab SOP, using the format set by the Office of Strategy and Performance. The uploading of SOP approvals and training for senior staff was expected to be completed by mid-July 2020. SOPs are reviewed annually as part of the management review.

Records of Lab fire drills are maintained by the plant operations, in addition to larger safety inspections related to HVAC (heating, ventilation and air conditioning), fire suppression systems, etc.

Laboratory Services

Compressed air, electrical services, deionized and distilled water, etc., are provided through separate contracts for each lab. The chemical hygiene plan sets forth the policies, procedures and guidelines in place to protect laboratory workers, and all calibrations are listed in the SOPs.

Special equipment and maintenance service contracts are used by City labs. Laboratory equipment and instrumentation are tracked and maintained under vendor service contracts.

Laboratory Safety

Hazards and concerns are documented and tracked on site. All safety data sheets (SDS) are maintained in a book. During the end-of-month quality assurance process, any duplicates and out-of-date information are removed. The CHP addresses SDSs and monthly modules of training being used as tailgate safety talks. There are monthly lab safety tailgate talks, which the labs are working to formalize. There are monthly checks of the laboratory for safe clearance of equipment through aisles and doorways.

All equipment and working surfaces are cleaned and disinfected after contact with samples, blood or potentially infectious materials. Baltimore City laboratory bacteriological requirements for sampling procedures and plans are in the CHP. Any autoclaved material is then sent out and collected by an outside vendor. All work surfaces are sanitized. All hazardous waste is collected by an outside vendor. All safety items are tracked on forms signed by supervisors. All new employees are trained within six months. Lab evacuations and other safety-specific training are also provided to new employees.

By facility and plant operation, the CHP includes evacuation routes and procedures. Laboratory emergency operations plan floor plans, evacuation routes and procedures are maintained on-site. Laboratory housekeeping and administrative records include fire drills. Exits and egresses, including doors, passageways or stairways that are not immediately apparent, are marked with visible signs. There are spill kits available, with written instructions included in the CHP.

Laboratory control ventilation (e.g., fume hoods) is inspected and maintained by maintenance annually. City laboratories follow facility policy pertaining to laboratory HVAC systems. Indoor air quality is inspected annually, and Inspection records are maintained for five years.

Laboratory reagents, solvents and compressed gases are periodically inspected. All cylinders are legibly marked to clearly identify the gas contained. All cylinders are located and stored in areas that are protected. Valve protectors are always placed on cylinders when the cylinder is not in use or connected for use. All compressors are equipped with pressure relief valves and pressure gauges.

There is proper cleaning and/or disposal of glassware with specialized preparation documented on-site.

City laboratories follow facility policy regarding laboratory electrical safety. City laboratories use the lockout/tagout procedures in the CHP.

The CHP describes laboratory infection control procedures. A blanket PPE contract with an outside vendor is used for shoes and for PPE, eye protection, gloves, etc.

Laboratory Data and Documentation

Laboratory manufacturer equipment service manuals, cut sheets and SDSs of all chemicals are available to all employees in the laboratory. The service manuals are typically kept near benches, and a copy is in the front office. Digital service manuals are kept for water quality labs, and some copies are in binders accessible to the analysts.

Laboratory hazard correction records (that document the inspection, date of inspection and persons conducting the inspection for unsafe conditions/unsafe work practices) are maintained.

Expect Performance

Baltimore City management must continue to work to provide an environment that encourages communication on safety and health issues. The implementation of an effective safety program must hold persons accountable for performance. Baltimore City has a positive recognition awards program.

The City must continue to provide recognition for meeting or exceeding safety and health goals aimed at preventing injury/illness (e.g., reporting close calls/near misses, attending training, conducting inspections and reporting unsafe occurrences).

Baltimore City must continue to establish ways to reinforce a safe work environment, encourage reporting and participation in safety and health concerns, provide access to safety information and training while allowing opportunities for workers to participate in all phases of safety implementation.

The City must establish realistic, measurable goals for improving safety and health. The City needs to provide staffing to meet the goals while emphasizing injury and illness prevention. The resources to implement the safety and health environment should be inclusive, rather than focusing on injury and illness rates.

The City needs to develop plans to achieve the goals by assigning tasks and responsibilities to particular individuals, or groups, setting timeframes, measuring performance and determining resource needs. These plans should be made available to all City staff.

Baltimore County

The DPW Safety Office reports to the Acting Director of DPW but is also responsible to the Director of the Office of Human Resources and the Director of the Office of Budget and Finance regarding implementation of the Countywide safety and health policy. The Safety Office also leads the DPW Training Academy, which is focused on improving employee work skills. The Safety Office is responsible for safety

training, worksite safety inspections, accident investigations and the development of safety standards and procedures. The Safety Office has an FY 2021 budget of $465,000 (an additional $295,000 is funded by Metropolitan District Financing) and has nine employees, including three safety officers with an unfilled vacancy for a fourth safety officer. County staff appears committed to protecting the safety and health of the workforce.

Like other jurisdictions across the nation, the COVID-19 pandemic has caused challenges for Baltimore County. However, the County has implemented safety standards and procedures intended to mitigate safety risks. The DPW Safety Office provides training and oversight of field activities to reduce risks to employees. The County also has an overall risk management program and a workers' compensation program.

Findings

The focus of this task is on the Baltimore County water and sewer safety program. However, references are made in this report to the County safety and health policy and the safety manual, where appropriate, to illustrate relationships and interactions which impact the County water and sewer safety program.

Organizational Structure

County Safety Organizational Structure: Baltimore County has an untraditional organizational structure in which the Safety Office reports to three separate organizations. Consistent with the organizational chart, the Safety Office reports to the Director of the DPW. The Safety and Health Policy states the Directors of the Human Resources and Budget & Finance Departments "Have the overall responsibility for the implementation and administration of the County's safety and health policy and the related self-insurance and risk-management program." The reporting relationship between the Safety Office and the DPW Director is not mentioned in the Safety and Health Policy or the County Safety Manual.

Safety Office Responsibilities: The safety manual charges the Safety Office with Countywide responsibilities for safety training, safety inspections and other safety-related responsibilities. These countywide safety responsibilities exclude uniformed employees and employees of the Board of Education, which has its own safety staff. The Safety Office is thus responsible for providing safety leadership and support for many organizations outside the Bureau of Utilities' water and sewer program.

Safety Program Re-Structuring: The FY 2021 budget outlined a significant structural change in the water and sewer safety program. Formerly, the Bureau of Utilities funded two safety officer positions, and one of the officers was essentially dedicated to Bureau safety matters. Interviews indicate that the safety officer formerly taught safety courses for Utilities employees are one day a week. It was reported that the assigned safety officer greatly improved the confined space entry procedures and evaluated confined spaces in all Utilities pump stations.

Under the FY 2021 budget, all the safety officers have been consolidated into the Safety Office. The new Safety Office has 11 positions consisting of four safety officer positions, a training and emergency operations coordinator, two office coordinators, three public works technicians and a management analyst. The FY 2021 operating and capital budget states that the creation of the new Safety Office "will enable appropriating the necessary funds to provide services, track expenditures and measure the effectiveness of the program."

Staff from the Safety Office advised that a safety officer is still principally assigned to Utilities and a backup safety officer is always available. However, a Bureau interviewee commented that he believes the relocation of the safety officer eliminated the opportunity for impromptu safety discussions with supervisors and the opportunity for informal walkthrough inspections.

Bureau of Utilities Supervisors Input: Bureau of Utilities supervisors report that they feel safe while performing their job duties. They also report that the Chief of the Bureau supports employee safety. However, 40% of the supervisors believe the Bureau safety program is not adequate due to inadequate safety training and the loss of the near full-time Bureau safety officer.

Although not directly addressing the concern of Utilities supervisors, Safety Office staff advised that all safety training for Utilities is current except for confined space training (due to COVID-19), and the Office is working on possible solutions for hands-on practical skills training.

Management Leadership

County Safety Program Leadership: The draft safety policy charges the Director of the Office of Human Resources and the Director of the Office of Budget and Finance with the overall responsibility for the implementation and administration of the County's safety and health policy.

OSHA recommends that the most senior executive in an organization, like a county chief executive, be responsible for employee safety and health. Research indicates that when the most senior executive is responsible for employee safety and health, it sends a reassuring message to employees about the organization's commitment to safety and health.

Safety Performance Goals and Objectives: Input from the staff of the Safety Office and Bureau of Utilities indicates that top management has not established (nor mandated the establishment of) safety goals and/or objectives for the Bureau. In addition, the Safety Office has not been required to track and report comprehensive safety metrics to be used by management to evaluate the effectiveness of the safety program. Safety Office staff states they compile some statistics that can be supplied upon request.

Safety Manual and Policy

Safety Manual: Baltimore County has had a safety manual in place for many years. The safety manual has recently been updated, with outdated sections revised.

Safety Manual - Department Head Responsibilities: The safety manual, in several instances, states that department heads and supervisors are responsible for reviewing detailed OSHA standards and developing written compliance procedures. The manual generally describes the role of the Safety Office to be available in a coordinating capacity and to make copies of the formal safety standards available to department heads.

It is not typical for an organization to require department heads and supervisors in each county department to read and understand the complex, legally enforceable requirements of an OSHA standard. Other jurisdictions have concluded this could lead to omissions, implementation and training inconsistencies and may be beyond the time available by hard-working department heads. In most county organizations, the safety professionals, with the support of the county attorneys, are responsible for understanding OSHA standards and developing compliance programs, while department heads or supervisors are responsible for ensuring the programs are implemented in their organizations.

Hazard Communication Program: As stated in the safety manual, department heads are responsible for a significant series of responsibilities related to compliance with the important OSHA hazard communication standard:

- Provide employees with training to include a summary of the standard, chemical properties, physical hazards, health hazards, protective procedures, spill clean-up procedures, location of safety data sheets and work practices
- Ensure all safety data sheets are obtained, maintained and distributed
- Identify and evaluate all operations involving hazardous chemicals

- Develop written procedures for the safe use, handling, storage and labeling of emergency procedures
- Understand the globally harmonized system (GHS) standard and apply it to ensure proper labeling

We have not assessed the compliance status of the County safety program. From our experience in other studies, we have learned that knowledgeable safety professionals must invest a significant amount of time in studying OSHA standards and developing plans or procedures to be followed to achieve compliance. It is unknown if department heads across the County agencies possess the knowledge and experience to meet the requirements of the safety manual.

It was reported that the Safety Office develops "general safety plans," with department heads responsible for using the general plans to create specific plans for their operations. The safety manual does not reference a Safety Office responsibility to create "general safety plans" but rather charges the department heads with the responsibility for developing plans, training, labeling, etc.

Personal Protective Equipment: The PPE procedure in the safety manual makes department heads responsible for:

- Conducting hazard assessment of workplaces
- Selecting PPE to protect employees from the identified hazards
- Ensuring the proper fit of PPE
- Conducting training on the proper use and maintenance of PPE
- Completing a written certification that employees have received and understand the training
- Maintaining training records

Safety Office staff advised that they conduct the hazard assessments of workplaces, which are not mentioned in the safety manual. Staff further advises that due to COVID-19, they are now asking supervisors to review the hazard assessments with employees and sign off.

Appendix B of the safety manual provides a hazard assessment guide. This guide is applicable for department heads to employ in conducting hazard assessments. The guide requires the following knowledge of OSHA standards, which better fit experienced safety officers than department heads:

- Knowledge of the capability and limits of all PPE
- Knowledge of 29 CFR (Code of Federal Regulations) 1910.133 (a) 5 on the allowable shade in visors
- Knowledge of Type I and Type II hard hat designations
- Knowledge of ANSI (American National Standards Institute) Z41 standard for foot protection
- Knowledge of 29 CFR 1910-132(a) and (b)
- Knowledge of Appendix B to 29 CFR 1910 Subpart I

Commitment to Protecting Employees: The County safety and health policy states "all practical steps will be taken to reduce and prevent accidents … and to insure the establishment of county-wide safe and healthful working practices and conditions." The policy pledges that the County "will comply with safety and health standards as required by the Federal Occupational Safety and Health Act and the Maryland Occupational Safety and Health Act." These are sound policy statements.

Strategic Plan - Safety: Baltimore County has included important safety goals in its strategic plan, including a commitment to reducing employee workplace injuries.

Worker Participation

Employee Safety Role: Water and sewer employees appear to understand the important role they play in employee safety. Supervisors appear to place the highest priority on protecting the safety and health of employees.

Employee's Safety Coordinators Committee: Baltimore County has established an employee safety committee that is charged with identifying policies and procedures which promote the best possible working conditions for County employees. Minutes from the two Committee meetings provided to the project team did not indicate any discussion of injuries or near misses or a discussion of planned actions to improve the County safety program.

In addition to the Employee's Safety Coordinators Committee, Safety Office staff report that the Office facilitates safety committee activities and prepares tailgate safety talks.

Safety Manual Implementation: Any time a new safety manual (or new safety procedures) is adopted, a comprehensive rollout effort should be undertaken to ensure all employees and supervisors understand and are capable of implementing the new procedures. Safety Office staff report that the Office regularly updates training and trains employees on all updates.

Hazard Identification and Assessment

A fundamental part of a safety program requires field supervisors to perform job safety analyses to ensure employees are adequately protected from job hazards. 60% of senior Bureau of Utilities supervisors report they have never received job safety analyses or hazard analysis training.

While not commenting on the training concern of supervisors, Safety Office staff stated that the Office has provided hazard assessments to the Bureau of Utilities and asked Bureau supervisors months ago to review them with employees and sign off. Safety Staff stated that "despite repeated requests to Utilities," some have not been signed off and returned.

Hazard Prevention and Control

Data and measurements are required to determine employee exposure to chemicals and to measure workplace noise exposures. In Section 2.3 of the safety manual on hearing protection, there is no indication of who is responsible for conducting noise surveys in workplaces, determining time-weighted noise exposures and mandating that the hearing protection program is followed. The safety manual also does not describe who is responsible for performing the sampling required to ensure data-based decisions can be made on employee workplace chemical exposures to protect employees. Safety Office staff reports that the Office retains outside contractors to perform this type of work due to staffing issues.

Confined Space Entry

A safety officer has invested significant resources into improving the tools available to County departments, including the Bureau of Utilities for confined space entries. The work included preparing confined space hazard assessments for entries into pump stations and other potentially hazardous locations and development of a confined space entry permit application and a confined space classification form. It appears that the new confined space procedures and forms are excellent. However, Safety Office staff noted that they solicited feedback from Utilities on many occasions and received none.

Education and Training

Safety Training During the Pandemic: The Safety Office advised that safety training had been placed "on hold" due to the pandemic but was reactivated in mid-August 2020.

Safety Manual - Training: The safety manual charges the Safety Office with the responsibility for developing and conducting supervisory and employee education and training courses. The text of several of the safety procedures appears, however, to be inconsistent with this stated role in that there is no reference to the Safety Office developing and delivering safety training.

Effectiveness of Safety Training: OSHA training requirements dictate that employees must be trained and, in some cases, periodically receive refresher training along with training when workplace conditions change. Bureau of Utilities supervisors recommended improvements be made in safety training, including more frequent classes, the use of better handouts, refreshed course materials, increased enthusiasm by instructors and testing to ensure employees understand the materials.

This item describes the recommended safety training improvements desired by Utilities supervisors. The intent of the item was to identify possible safety training improvements that field supervisors (i.e., safety customers) believe would improve the quality of the training.

Safety Office staff input on this item indicates that at some time, they met with MOSH, and MOSH recommended that they continue teaching their in-house training programs. Office staff also stated that "Every effort is made to accommodate their (Utilities) training needs from only being able to teach on Wednesdays and making special accommodations for after hour crews."

Safety Training Records Management: The safety manual does not contain a process or assign clear overall responsibilities for a safety training records management program. Several of the safety procedures in the manual require department heads or supervisors to maintain department-level safety training records. Many jurisdictions have a central safety training database to ensure that records are properly maintained and can be periodically reviewed to ensure that employees are receiving required safety training. While an older safety training database reportedly exists, it does not perform the functions that we believe the County requires to properly track, plan, issue training notices and document training. A sound safety training records management system can ensure training documentation can be provided to address the concerns of safety regulators or defend against legal claims.

Safety Office staff stated that as a best practice, they recommend that each agency construct and manage its own safety training records database.

Certified Safety Trainers: Staff from Baltimore City reported that their safety trainers are certified by the Chesapeake Regional Safety Council. The Safety Office reported that none of the County safety officers are certified safety trainers by an independent, external authority. The Safety Office notes that the officers have attended various safety training courses and received "instructor certifications" from recognized safety training organizations.

We believe that as a best practice, all safety trainers become certified by an independent organization like the Chesapeake Region Safety Council.

Toolbox Safety Talks: The Safety Office provides monthly toolbox safety talk materials to the Bureau of Utilities. These talks help heighten safety awareness and create enthusiasm among employees.

Employee Skills Development: Baltimore County has made a significant commitment to educating and developing the job skills of its employees. The improvement of work skills has the benefit of educating employees so they can perform their duties efficiently and safely.

Program Evaluation and Improvement

Safety Program Evaluation and Continuous Improvement: OSHA recommends that organizations require a regular, independent assessment of safety programs. The assessment should include a review of the effectiveness of the program and the development of an action plan to implement improvements. The County should conduct this type of assessment each year and commit to continuously improving the employee safety program.

Field Safety Inspections: The Safety Office reported that in 2019 only four safety inspections were performed for the Bureau of Utilities. Bureau supervisors believe there needs to be an increase in Safety Office workplace inspections and visits to job sites.

Commitment to Implementing Best Practices: Baltimore County's safety and health policy rightfully commits the County to comply with all lawful safety laws and standards, but the policy does not specifically commit the County to implement safety best practices.

Bureau of Utilities Supervisors Safety Observations: Two Bureau of Utilities supervisors reported that they observed City repair crews failing to adhere to proper safety procedures while working on water line repairs in the County.

Safety Office Staffing: The Safety Office presently has a vacancy for a safety officer, which was approved in the recent budget. However, the position is on hold due to the COVID-19 pandemic.

Safety Program Staffing Guidelines: The recommended level of safety staff to employees is a function of the size of the organization, the inherent risks of the business and the goals and objectives of the organization. Published guidelines provide a window into possible staffing levels, but a comprehensive staffing review is required to determine the correct safety staffing for an organization. Applying one commonly used guideline to the Bureau of Utilities indicates the Bureau needs around 1.5 full-time safety professionals to support their safety needs. Staff from the Safety Office reports that they are seeking approval to fill the vacant safety officer position.

Near Miss Reporting: An organization needs to capture and analyze near misses and develop training to minimize or eliminate future injuries. The Safety Office reported, "We have demoted people in Utilities for violating safety policies (considered a near-miss) without an accident." One interviewee characterized the County's near-miss reporting system to be "poor" in that supervisors are hesitant to report near misses.

Safety Awards and Recognition: Bureau of Utilities supervisors report that the Bureau does not currently formally recognize safety milestones or reward outstanding individual or group safety performance.

DPW - Utilities Laboratory: The Utilities lab has a chemical hygiene plan, which serves as a laboratory safety plan. The lab advises that inspections of eyewash stations and fume hoods have been inspected on "an irregular schedule," but plans are to conduct inspections on a regular schedule "as staff returns in the office."

Chief of the Safety Office Position Description: The Safety Office reported that there is no position-specific job description for Chief of the Safety Office.

Training and Emergency Operations Coordinator Position Description: The new "Training and Emergency Operations Coordinator" position description states that this position "oversees the Department of Public Works Safety and Training Division." Further, the position description states this individual "oversees the daily activities" and "develops and administers new and existing training programs." This appears to be at variance with other County documents, which state that the Chief of the Safety Office ("Management Analyst"), not the Training and Emergency Operations Coordinator, oversees and manages the safety program.

Job Descriptions/Class Specifications for Utilities Leadership Staff: The class specifications for the Chief, Bureau of Utilities and the Utilities Superintendent(s) [Water and Sewer] have very limited references to employee safety and health, and they do not require any specific experience implementing or overseeing the implementation of safety procedures.

Communications and Coordination with Contract Employees, Outside Contractors and Others

MOSH Inspection Procedure: The draft safety manual outlines a procedure to be followed during a MOSH regulatory inspection. The opening paragraph of the procedure states that Baltimore County needs to be "in control of the inspection." In a section that follows, it requests that County staff "learn what you can about the inspector's background."

While it was reported that the Safety Office has an excellent rapport with MOSH and frequently uses it as a resource, the procedure within the manual does not reference any positive benefits of a MOSH or OSHA inspection. Other jurisdictions have found that government inspections can help identify hazards before they cause injuries and can educate staff on proper safety procedures. These inspections also represent an opportunity for employees to ask questions or address issues of concern.

Contractor Safety Program: Safety Office staff advised that Safety does not get involved in overseeing the safety performance of Bureau of Utilities contractors unless a question or complaint is brought to their attention.

COVID-19 Pandemic Response

The Chief of the Bureau of Utilities has consulted with regional utilities, government authorities and others to ensure the Bureau implemented steps to adequately protect staff while still providing essential services to the community. The Safety Office has spearheaded efforts to ensure an adequate supply of PPE and disinfection supplies. All the Bureau of Utilities supervisors responding to the questionnaire agreed that water and sewer employees have had an ample supply of PPE during the pandemic.

Best Practices

Organizational Structure

Monitoring Organizational Change: After a significant organizational change, it is important to closely monitor the effectiveness of the change to ensure that safety professionals do not lose touch with the operations staff or that separate "silos" do not develop.

Management Leadership

Top Management Safety Commitment: Top management should require that employee safety and health become a core value of the organization. Top management should visibly demonstrate their commitment to employee safety and health, provide adequate resources and actively monitor safety performance.

Reinforce Management Safety Commitment: Supervisors across the organization should reinforce top management's safety commitment by considering safety and health in all business decisions, including contractor and vendor selection, purchasing and facility design.

Department Head Safety Responsibilities: Department heads must play an important role in employee safety. Their role should be to support the implementation of sound safety procedures in their organization and to hold their staff responsible for supporting employee safety and health.

Safety Staffing: The organization should periodically perform an in-depth study to determine if the safety program is properly staffed. The staffing review should take into account the roles outlined in all existing safety procedures, along with the views of employees and field supervisors.

Safety Vision Statement: The organization should consider adopting a safety vision statement like "The protection of employee health and safety will be given precedence over operations whenever an unsafe condition arises."

Establishment of Safety Performance Goals: Safety performance goals should be developed and implemented. Performance should be measured against these goals and results reviewed regularly. Evaluation of the results should be a formal part of all supervisors' performance reviews.

Establishment of a Safety Performance Dashboard: A safety performance dashboard should be developed and implemented to continuously communicate current key safety performance data to top management and operations leaders.

Safety Organization Performance Metrics: Formal performance metrics should be established for the safety organization, and regular reviews of performance should be conducted by management. Examples of metrics include recordable incidents, hours of safety training, DART (days away, restricted or transferred), number of employees trained, number of safety inspections performed, near misses, feedback from operations, etc.

Chief Safety Officer Job Description: The job description for the leader of a safety program should specifically require high-level experience in a similar position, extensive knowledge of safety laws/regulations, team building and communication skills and require desirable professional certifications.

Senior Operations Leaders Job Descriptions: The job descriptions for senior operations leadership positions should require experience protecting employees and general knowledge of safety procedures and best practices.

Worker Participation

Employee Participation: Employees should be actively involved in all aspects of the safety program, including setting goals, identifying hazards, investigating accidents and establishing safety procedures. Free and open communication channels are essential, and no employee should ever fear retaliation if they bring forward a safety concern.

Empower Employees: Employees should be empowered to temporarily suspend or shut down any work activity or operation they feel is unsafe.

Hazard Identification and Assessment

Hazard Assessments for Significant Risks: Safety professionals are trained to analyze workplace hazards and assess the risks to employees. Assessments should be data-driven and supported by monitoring and exposure assessments. Department heads would not be expected to have the training, or the available time, to complete complex assessments.

Hazard Identification: Supervisors and managers should be trained to perform hazard investigations where they have the expertise and training.

Hazard Prevention and Control

Hierarchy of Controls: A comprehensive industrial hygiene sampling program should be implemented, including employee exposure monitoring and workplace noise testing, to provide the data required to properly implement OSHA's hierarchy of controls to protect employee safety and health.

Safety Equipment Inspections: All required inspections of safety equipment should be maintained during a pandemic if employees are present in the workplace. Management should ensure that adequate staff is available to perform necessary safety inspections during a pandemic.

Field Observation Reporting Procedure: A procedure should be in place to guide field supervisors on how to alert a neighboring jurisdiction if they believe safety procedures are not being followed in the field.

Education and Training

Safety Training: A comprehensive review of a safety training program, including input from employees and operations supervisors, should periodically be performed to ensure that the safety training program accomplishes organizational goals and meets operations and employee needs.

Employee Safety Training Record Keeping System: A central safety training record keeping system should be in place, which defines the safety training requirements for each position, documents the training received by each employee and provides advance notice to supervisors of upcoming training needs. The system should also document the date an individual was trained, the name of the instructor, the course content and the training method (classroom, on-the-job training, zoom training, etc.). It should also contain sign-in sheets with signatures and describe the method used to ensure the training was understood.

Train-the-Trainers: Supervisors play an important role in field safety training and thus should be educated about effective training methods and skills. Staff from the Safety Office advised that they offer a train-the-trainer program.

Safety Trainer Certification: Independent certification of all safety trainers helps ensure that employees receive the best possible safety training.

Toolbox Safety Talks: Toolbox safety talks should be conducted weekly as recommended by the AWWA.

Program Evaluation and Improvement

Commitment to Best Practices: A safety and health policy is enhanced if it commits an organization to implement best practices to protect the health and safety of employees.

Independent Annual Safety Program Review: Top management should require an independent annual review of the overall effectiveness of the safety program. The review should include an analysis of injury data and near misses, an assessment of the progress in fully implementing safety procedures and incorporate input from employees and supervisors. The review should provide recommendations for improving the safety program along with an implementation schedule.

Field Safety Inspections: Leading safety organizations place a priority on conducting safety inspections in the field and shops.

Tracking and Learning from Near Misses: Emphasis should be placed on near-miss reporting and educating employees on the lessons learned from near misses. Any barriers to reporting should be identified and resolved.

Communication and Coordination for Host Employees, Contractors and Others

Sustainable, Effective Partnerships: The goal of all policies and procedures should be to develop and sustain effective partnerships with regulatory agencies, customers, community stakeholders, educators and regional partners.

Safety Coordination Between Jurisdictions: Entities that share water and sewer responsibilities, or work close to each other, should meet regularly to share experiences, review lessons learned in the field, identify opportunities for joint initiatives and ensure open communications.

Contractor Safety: A formal contractor safety program should be in place. The safety program should detail contractor safety requirements and expectations, require a project-specific safety plan when appropriate and require contractors to report accidents and near-misses. Safety professionals should

oversee contractor safety performance, including reviewing contractor safety plans and performing worksite inspections.

COVID-19 Response

COVID-19 Lessons Learned: Operations and safety staff should be assembled to analyze the response to the pandemic and develop "lessons learned" guidance for the future. The lessons learned should be incorporated into a pandemic operating plan or a pandemic amendment to the emergency response plan.

High-Level Observations

Baltimore City

Organizational Structure

- In 2019, the safety program was restructured to report directly to the Director.
- The Director's role is to set the Water & Wastewater Bureau direction by communicating a vision and mission as well as establishing core principles and values, providing training and overseeing implementation.
- Managers at all levels in the City's organizational structure indicate full support for employee safety and health as a core organizational value.
- A periodic review of the safety structure has been found helpful by other organizations.
- A safety and health committee has been implemented with safety coordinators at field locations; however, more assistance is needed because this volunteer duty is not their only responsibility.
- A policy on the reporting of field safety and health issues beyond the facility level would be desirable.

Management Leadership

- Top management, directors and division chiefs report they are committed to eliminating safety hazards and improving workplace safety and health.
- Many organizations establish formal safety goals and expectations, assign responsibilities and measure performance and continuously imp[rove safety performance.
- Managers at all levels of the City indicate they value health and safety goals.

Worker Participation

- The safety committee and all 22 safety volunteer coordinators workers are involved in many aspects of health and safety, with training provided as needed by internal OSHA approved instructors
- Policy requires all workers, including contractors, seasonal, temporary and part-time workers, be properly trained in DOT, OSHA, MOSH and AHA safe work practices guidelines.
- The process for identifying, reporting, investigating and tracking hazards and incidents encourages all workers to openly communicate, report, remove and address issues and to receive guidance from management, OST and the Office of Risk Management & Division of Safety without fear of retaliation.

Hazard Identification and Assessment

- The DPW OST and Office of Risk Management & Division of Safety have procedures in place to identify workplace hazards and evaluate risk.
- Safety coordinators communicate emergencies directly to local managers and the OST or Office of Risk Management & Division of Safety for identification and assessment.
- The Office of Risk Management & Division of Safety and OST investigates all incidents to determine the root cause. All findings are assessed and reported; managers work toward remediation or prioritization for control.

Hazard Prevention and Control

- Top management, directors and division chiefs cooperate with safety staff to eliminate hazards and improve workplace safety and health following OSHA's guidelines and regulations.
- All managers are expected to implement the OSHA hierarchy of controls that use engineering solutions, safe work practices with tailgate talks, administrative controls and the use of personal protective equipment at no cost to personnel.
- The City safety and health plan ensures controls are implemented, and progress is tracked using Qualtrax software, currently being implemented to move all paper forms to electronic media.

Education and Training

- The City has OSHA-approved trainers that provide workers with training in-house (e.g., OSHA 10, OSHA 30, CDL, confined space, trench and excavation, CPR/first aid, etc.). If training cannot be scheduled in-house, then training is provided by outside sources, such as colleges or safety training companies.
- Employers, managers, supervisors and coordinators receive training on OSHA concepts, workers' rights and OSHA 300 reporting.
- Employee training is tracked, and all certifications and recertifications are scheduled following OSHA training requirements for compliance.

Program Evaluation and Improvement

- The City has some employee safety deficiencies which need to be addressed and assessed.
- Safety committee minutes and reports need to be better standardized.
- While having safety coordinators for every location is a good practice, one-year voluntary assignments (after which the role rotates to another individual) can result in a lack of consistency, oversight and compliance.
- Digitization of documents is a work in progress as O&M manuals, job safety analyses, reports and records are being uploaded to an automated digital platform.

Communications and Coordination with Contract Employees and Outside Contractors

- Adherence to the City's "Green Book" is mandatory for all contractors and staffing agencies to ensure the same level of safety and health protection for all employees.
- All contractors are required to report all hazards present at the worksite and all impacts to safety and health. A copy of the contractor's safety program for each project is provided to the engineering department, OST and the Office of Risk Management & Division of Safety before start of work.
- There is no formal joint safety coordination with the County.

Response to COVID–19

- Following COVID-19 guidance from the Mayor's Office, the City quickly made efforts to downsize operations, adjust shifts and establish protocols based on CDC guidelines to ensure the safety of all personnel.
- All guidance related to COVID 19 is communicated to DPW management and then DPW employees.
- The City reports that additional detailed planning has been performed; although, based on interviews with safety staff, it appears that there are communication and implementation issues that need to be addressed.

Baltimore County

Organizational Structure

- The County's safety program has recently been restructured. This organizational change should be monitored to ensure it meets objectives and that silos do not form.

- Safety responsibilities are untraditional in that the Safety Office is responsible to three separate County departments. A structure of this type is not recommended by OSHA or by safety experts.
- Field supervisors are concerned with the new structure and believe the loss of the on-site safety officer will adversely affect the safety of employees within the Bureau of Utilities.

Management Leadership

- The County is currently updating its safety manual.
- OSHA recommends that the most senior executive in an organization be responsible for safety. In Baltimore County, a senior executive is not responsible for employee safety. A fundamental element of an effective safety program is the establishment of safety goals and objectives. The goals and objectives should be established by the top executive and personally monitored to ensure they are achieved. No formal safety goals have been established by County management.
- Safety roles and responsibilities are unclear. Department heads are expected to read, understand, develop detailed compliance plans, train employees and oversee compliance. For example, department heads are held responsible for selecting PPE and fit testing employees. These responsibilities are typically assigned to safety professionals who have the expertise to develop compliance plans, train employees and independently audit compliance. Several safety procedures prescribe the role of the Safety Office to be advisory and to provide copies of OSHA standards.
- The Safety Office has broad County-wide safety responsibilities with a limited staff. A staffing review should be performed to ensure that an adequate number of safety officers are available to lead a high-performing safety program.
- Effective safety programs typically reward safety performance for both organizations and individuals. There is no formal safety rewards program for the Bureau of Utilities or other organizations.

Worker Participation

- Employees and supervisors appear to understand their role in safety. They believe the Chief is committed to protecting employee safety and health.
- An employee safety coordinators' committee exists. However, the minutes supplied to the project team do not indicate that the committee is focused on strategic issues like reportable injuries, near misses and accident investigations.
- Employees are not involved in all aspects of the safety program, such as accident investigations, goal setting and tracking progress.

Hazard Identification and Assessment

- The County safety manual delegates significant responsibilities to department heads in identifying hazards and assessing control measures. This role is generally assigned to safety professionals who can draw upon operations as needed to assist in understanding processes.
- The Safety Office has published a guideline for assessing safety hazards.
- Supervisors feel hazard identification training by the Safety Office needs improvement.

Hazard Prevention and Control

- The County's safety and health policy commits the County to protect the safety and health of employees.
- It is a fundamental role for trained safety experts to monitor employee exposures and test workplace noise exposures to secure the data necessary to determine if corrective actions are required to protect employee safety and health. The responsibilities for workplace monitoring and exposure testing are not outlined in the safety manual.
- The OSHA hierarchy of controls should be an integral part of the safety manual.

Education and Training

- Supervisors believe safety training needs improvement. They believe that course materials should be refreshed, the frequency of courses increased, post-training testing performed and safety training programs energized.
- No central safety training tracking system exists. A single training tracking system should be in place to ensure employees receive timely training. It is also important that advance notices of training are provided and that the County can document training to regulators and others.
- County safety trainers are not independently certified like they are in Baltimore City.
- The County training academy is an asset to the safety program.

Program Evaluation and Improvement

- No regular process to evaluate the safety program and require improvements exists. An independent annual review of the safety program should be required.
- No written commitment to continuous improvement is contained in the County's safety and health policy.
- The strategic plan contains plans to implement safety best practices, but the safety policy lacks a commitment to best practices.
- In FY 2019, the Safety Office only performed four field safety inspections in the Bureau of Utilities, which is low given the risks encountered by Bureau employees daily. The Safety Office should significantly increase the field safety inspections by safety professionals.
- The job specifications for Bureau of Utilities operations leaders lack important safety-related job qualifications.
- The Safety Chief job specification should list the required experience and qualifications for the position.

Communications and Coordination with Contract Employees and Outside Contractors

- The safety manual does not articulate the benefits of regulatory partnerships.
- The City and County operate in close proximity to each other, and employees from both jurisdictions are often jointly involved in field maintenance and emergency response. Currently, there is a lack of communications with the City and no joint safety initiatives.
- No formal contractor safety program exists in the County. Safety officers do not review contractor safety plans or inspect contractor work sites unless the Safety Office is requested to become involved.

Response to COVID-19

- During COVID-19, the Bureau of Utilities Chief has taken the initiative to protect employees while still providing essential services to citizens. The Safety Office did an effective job of securing needed PPE to protect employees.
- The County should perform a "lessons learned" review of its response to COVID-19.
- The County should incorporate the lessons learned into a pandemic response plan or amend its emergency response plan to address the pandemic lessons learned.

Task 4.5 Source Water Protection and Land Use Management Planning

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review the overall source water protection initiatives and land use management planning in the City and County and inter-governmental coordination where applicable
- Provide high-level observations

Methodology

The methodology of this evaluation consisted of a review of relevant documents, followed by interviews with staff whose responsibilities covered areas under review and an assessment of this information based on industry standards and best practices. The documents reviewed included:

Provided from Baltimore City

- 2005 Reservoir Watershed Management Agreement
- 2017-2018 Progress Report on Implementation of the 2005 Reservoir Watershed Action Strategy
- 2006 Watershed Agreement; MOU between City and County
- Susquehanna River Basin Commission Docket No.20010801 (Aug 9, 2001)
- Susquehanna River Basin Commission Docket No.20010801.1 (Sept 15, 2011)
- Maryland's Source Water Assessment Program; January 29, 1999
- Project No. 812, Task 6 Liberty Reservoir Watershed Assessment; April 2003 (report by Gannet Fleming)
- Source Water Assessment and Protection Report; May 30, 2003
- "A Comprehensive Forest Conservation Plan for Long-term Watershed Protection on the City of Baltimore's Reservoirs," January 2003

Provided from Baltimore County

- Small Watershed Action plans (2008-2018)
- Total Maximum Daily Limit (TMDL) implementation plan reports for Loch Raven, Prettyboy and Liberty reservoirs
- NPDES and MS4 report (2019)
- Sanitary Sewer System Consent decree
- 2017-2018 Progress Report on Implementation of the 2005 Reservoir Watershed Action Strategy

Summary of City and County Practices

Exhibit 4-12. Summary of City and County Practices - Source Water Protection and Land Use Management Planning

Element	City	County	Comment
Vision and Stakeholder Involvement	▪ Many years ago, the City performed much better on this element, but traction has been lost	▪ Numerous regulated, permit and voluntary programs have dimensions of stakeholder involvement	▪ Updates to City programs and enhanced coordination efforts between City and County may be valuable here ▪ COVID-19 pandemic responses likely impacted this element

Exhibit 4-12. Summary of City and County Practices - Source Water Protection and Land Use Management Planning

Element	City	County	Comment
Characterization	▪ The City's knowledge base of characterization for source water and watersheds is strong, but reporting is out of date ▪ An updated forest survey is needed and is in the planning stages	▪ Various programs deliver regular updates to source water characterization information	▪ Updates to City programs and policies are needed, and some are underway
Goals	▪ Goals are defined in City program documents, but these documents are many years old	▪ Goals are well defined in County program reports	▪ Updates or formal reaffirmation of existing City plans are needed
Action Plan	▪ A strong action plan was defined in the 2003 Forest Management Plan	▪ Action plans are well defined in County program reports	▪ Updates or formal reaffirmation of existing City plans are needed
Implementation	▪ The City's self-reported performance concerning the action plan described in the 2003 Forest Management plan was good, with some items identified as in need of improvement	▪ Implementation appears to be on track, and all regulated programs are in compliance	
Evaluation and Revision	▪ The City's programs performed most poorly in this item	▪ All items reviewed for this report were found to be current, with some updates in progress	▪ COVID-19 pandemic responses may have impacted this item

Findings

The exhibit below presents a score of one to five (five being best) for the City's performance concerning each core element of the AWWA Source Water Protection Guide. The overview of these elements from this standard is as follows.

Vision and Stakeholder Involvement

- "The utility shall have a vision or policy that expresses a commitment to source water protection."
- "The utility shall identify source water area stakeholders, their roles, and existing initiatives in which they may be engaged."

Characterization

The utility shall develop a characterization of the source water that includes:

- Delineation
- Water quality and quantity data
- Contaminant sources
- Land use and other threats

- Inventory of regulations
- Delineation
- Water quality and quantity data
- Contaminant sources
- Land use and other threats
- Inventory of regulations

Source Water Protection Goals

"The goals shall address water quality issues, such as, public health and aesthetic concerns, and may also include other considerations, such as environmental stewardship, ecological balance, socioeconomic and political equity, tradeoffs with competing policy objectives and others."

Action Plan

"The action plan identifies required actions needed to mitigate existing and future threats to source water quality. It establishes priorities and sets a timetable to implement source water protection goals."

Program Implementation

"Implementation of the action plan is key to a successful source water protection program. The utility should where appropriate, develop, promote. Or implement a combination of voluntary and regulatory programs and sound practices."

Evaluation and Revision

"Source water protection plans shall be periodically evaluated and revised in response to changes in the area of source water delineation, new data or information, new regulations, changes in local priorities, actual implemented programs, and so forth."

Exhibit 4-13. Performance Score

Element*	City	County
Vision and Stakeholder Involvement	3	5
Characterization	4	5
Goals	3	5
Action Plan	3	5
Implementation	4	5
Evaluation and Revision	1	5

* Scores shown in this exhibit incorporate input from interviewees but are primarily the opinions of the investigators.

Vision and Stakeholder Involvement: There is evidence that these efforts were very strong during the development of the framework documents. Over time, traction has been lost in some areas, and reengaging with stakeholder groups has been identified as a need by City staff. One valuable mechanism for stakeholder engagement that continues to function is the Watershed Management Committee and Technical Group. Both were formed as a result of the 2005 Watershed Agreement.

Characterization: A robust inventory and understanding of the reservoir areas under City management were well established during the formation of the framework documents, notably as part of the Forest Management Plan of 2003. With a new assessment currently underway, the City scores well in this area.

Goals: Well-defined and appropriate goals are identified in the original framework documents, but some priorities have shifted in the ensuing years, and this may not be well captured in official policy documents today.

Action Plan: Original framework documents identify and describe action items. However, updates are needed. As an example, the 2003 Forest Management Plan provides both a "Long-term Forest Conservation Operational Objectives" (12 specified items) and a "10 Year Schedule of Work" (19 specified items).

Implementation: Performance on the items listed in the 2003 Forest Management Plan is generally on track as reported by the City. Three areas were identified for further improvement.

1. Forest inventory diversity
2. Reducing negative impacts from recreational use
3. Deer management

Evaluation and Revision: All framework and guidance documents are due for updates.

The Reservoir Tech Group (per 2005 Reservoir Agreement) is active, and the chair has been interviewed as part of this evaluation. The Group has a more "on the ground" and "behind the scenes" role but continues to make important contributions (e.g., MS4 permit influence). The Group's role is largely to monitor and manage the reservoir system and then make recommendations to the Committee. The Committee then determines policy outcomes and carries out policy execution. The City currently provides funding to support Baltimore Metropolitan Council (BMC) staff per the 2005 Watershed Agreement.

The Forest Management Plan (2003) provides a strong baseline for a watershed management plan with a secondary focus on silviculture. Previous forest management practices were oriented toward commercial uses (specifically for City use of consumable lumber). City DPW expressed a desire for a new management strategy to be oriented more toward sustainability. A key feature of this would be a better-optimized tree inventory (e.g., more diverse age distribution) but also includes more aggressive deer management and recreational use management).

City DPW staff noted that one challenge to meeting the goals of the forest management plan (2003) is unauthorized trail making, believed to be done for mountain biking. Improved management of recreational access is needed to counter this. Reestablishing stakeholder engagement efforts with user groups that were a component of the 2003 Forest Management Plan may facilitate this goal.

City DPW staff expressed the desire for a third-party study to help make a case for roadway area reductions.

City DPW staff desires more communication/coordination with watershed stakeholders (recreational/public and officials at the State and County levels).

There is a comprehensive watershed forest assessment study currently underway. This initiative is currently in the RFP process. What the City desires as part of the outcome is a sector-by-sector level analysis with specific recommendations for each unit.

The City is currently under a consent decree to cover all finished water reservoirs. While at the time of this report, two large reservoirs remain uncompleted (Druid Lake and Ashburton), it was reported that the City is on budget and on time with an anticipated completion date within the next two years. All smaller sites have been completed, with the exception of Guilford, which is 95% complete.

There is the desire on behalf of City DPW for a new forest management strategy to be oriented toward sustainability (deer management, recreational use management, better-optimized tree inventory, etc.). Support for this may be generated during efforts to review and update the 2003 plan.

The review of County provided documentation and follow-up questions showed a robust and multifaceted source water protection program. Each watershed is broken down into sub-catchment levels with current reports and updated plans for each (Small Watershed Action Plans). Permitted and regulated activities have updated reports that are in compliance. These initiatives include TMDL for specific water sources, NPDES and MS4 programs. Land-use policies that support watershed protection are also in place.

Best Practices

The primary standard used for assessment in this review was AWWA *G300-14 Source Water Protection*. This guide identifies six fundamental elements that comprise the minimum requirements for successful source water protection:

1. A source water protection program vision and stakeholder involvement
2. Source water characterization
3. Source water protection goals
4. Source water protection action plan
5. Implementation of the action plan
6. Periodic evaluation and revision of the entire plan

The six elements were evaluated at a high level in keeping with the scope of this task.

High-Level Observations

The framework documents currently being used by the City appear to be in line with current standards and best practices. Despite being over ten years old, these documents provide a framework that generally reflects current best practices. Enough time has passed, and changes have occurred that make updating these documents warranted.

The comprehensive watershed study currently in the RFP project stage will provide a significant update to the watershed and tree cover inventory baseline developed for the 2003 Forest Management Plan. The anticipated sector by sector analysis from this initiative will provide a substantial asset in planning and re-baseline efforts. Beyond that, this study may help address pushback from other stakeholder groups. Specifically, recreational users desire increased access from roadways. Additional data and analysis will be an asset in making the case that roadway reductions are beneficial to source water.

In some cases, staff turnover has contributed to loss of continuity. This was evident during the document request portion of this investigation and confirmed in interviews. Some staff have remained in their current departments for longer tenures, but overall turnover has caused shifts in areas of focus, as well as the decreased reliance on core plans.

The County manages most of the land within the source water watershed areas. As stated previously, these programs, policies and activities were found to be current, in compliance and keeping with industry standards. This report found no evidence of potential conflicts with City efforts or responsibilities. There are some areas where additional coordination could produce improved outcomes. Two such areas are deer herd management and recreational use management.

Task 4.6 Performance Management and Continuous Improvement

Scope

The City's Office of Strategy and Performance Management tracks various types of performance data and is in the process of streamlining data capture and tracking. The County has its own performance management related processes. The project team was requested to perform the following scope of services for this subtask:

- Review the City and County's respective performance management processes, including data capture and validation, analytics and continuous improvement approaches
- Review and summarize the key performance measures by functional area, including safety programs that the City and County have defined for the water and sewer utility operations
- Review the data capture, validation, tracking, analysis and performance management reporting processes and protocols
- Provide high-level objective observations on the overall performance management and continuous improvement processes and systems that the City and County use concerning performance management, intergovernmental coordination and exchange of performance measurement information

Note: *Task 4.7 Interjurisdiction Communication* addresses the sharing of performance measurement information and inter-governmental coordination. Inter-governmental communication and coordination are also addressed in other tasks.

Methodology

Our approach began by defining the elements of a high-performing performance management and continuous improvement (PM&CI) program. This was synthesized from Baldrige award criteria (https://www.nist.gov/baldrige), the AWWA benchmarking program (https://www.awwa.org/Resources-Tools/Programs/Benchmarking), and Effective Utility Management (EUM, https://www.watereum.org). In addition, this was supplemented by our experience in assisting utilities in the development of strategic plans, performance management systems, continuous improvement programs and numerous award applications. As a result of our synthesis of these various sources, our framework for analyzing performance management and continuous improvement consists of:

Strategic Plan - The strategic plan is the basis for KPIs, metrics that measure the success of the strategic plan. Several strategic plan frameworks are utilized. One common plan consists of the following elements: Goal (what do we want to achieve?); Strategy (what is our approach to achieving the goal?); Practices (how will we change how we do things or add technology to implement the strategies); and Performance Measures (how do we know if we are successful?). A well-developed strategic plan should include the following:

- A comprehensive effort to develop the plan
- Input from internal and external stakeholders
- A set of KPIs that measure success of the various goals of the strategic plan; KPIs should include specific targets (not just year over year improvement)
- Regular goal team meetings to track progress and identify areas requiring improvement (for those strategic plans that utilize goal teams to track progress); goal teams formed from a mix of employees improve workforce buy-in and provide training opportunities
- Annual reviews and updates; five-year major updates

Performance management program - A well-developed performance management program should include:

- A set of performance measures (a balance between efficiency, effectiveness and output measures is ideal)
- Data definitions and sample calculations
- Comparisons to others - This is usually done by constructing peer utility groups using mechanisms such as AWWA benchmarking or other annual and regional surveys
- Performance targets - This can be either performance compared to peer utilities (i.e., better than median, top-quartile, etc.) or best practices. Only when peer utility groups are difficult to form should there be self-comparison (i.e., year over year improvement).
- Regular reviews of performance (monthly and quarterly) - These should include a methodology for adjusting easily beat targets and a methodology for addressing failures to meet targets (this is discussed in the section of continuous improvement). Reviews also can provide a forum for continuous improvement, such as analyzing the practices of high-performing units for lessons learned and performing root cause analysis (RCA) or similar approaches for low-performing areas.
- Many utility management programs perform an annual performance review using a framework such as Effective Utility Management, Baldrige criteria or strategic planning. These performance reviews are provided to elected officials and, frequently, to customers.

Continuous Improvement - Numerous continuous improvement approaches have proven effective in water and sewer utilities. The important thing is to commit to improvement. Some methods utilized include:

- Analyzing high-performing elements of the utility - If targets are easily beat, targets should be adjusted. Also, the practices of high performers can be analyzed (through process mapping or similar approaches) to determine if they can be utilized by low performers.
- Analyzing low performers - Common techniques include root cause analysis of failures and failure modes and effects analysis (FMEA) performed in association with process mapping.
- Process maps performed as part of succession planning can be analyzed for opportunities for improvement (OFI).
- Implementing best practices - One construction BMP is to perform lessons learned analysis.
- More complex continuous improvement techniques include Six Sigma, Lean techniques and others.

Following the above steps, we initiated data gathering, including:

- Obtaining the appropriate strategic plans – Baltimore County's strategic plan and Baltimore City DPW's strategic plan
- Reviewing various performance reporting documents
- Interviewing performance management managers in the two entities
- Inviting the City and County personnel to perform a self-assessment
- Comparing the PM&CI programs of the two entities to the individual elements of the high-performing PM&CI program described above
- Reviewing Baltimore's 2017 AMWA (Association of Metropolitan Water Agencies) Gold Award for Exceptional Utility Performance application

Summary of City and County Practices

Exhibit 4-14. Summary of City and County Practices - Performance Management and Continuous Improvement

Element	City	County	Comment
Performance Management Process			
Strategic Plan	▪ The 2014 DPW strategic plan was well developed and followed up to 18 months later ▪ Everything is on hold pending a new DPW strategic plan	▪ The County has a well-developed strategic plan ▪ The strategic plan needs to be analyzed to set DPW directions and identify outcome measures ▪ The strategic plan timeline calls for a performance measurement program (PMP) this year	▪ A good PMP program needs a good strategic plan
Performance Measures	▪ At least 53 KPIs are being tracked separately by six Division-level organizations within DPW ▪ Most performance measures are efficiency-based and do not fully cover EUM framework	▪ At least 45 KPIs are being tracked within DPW ▪ The Bureau of Utilities is proposing an expansion to 80 KPIs ▪ Most performance measures are efficiency-based and do not fully cover EUM framework	▪ A world-class set of performance measures should balance efficiency, effectiveness and outcome measures ▪ The KPIs should cover utility operations (such as EUM) and have best practice targets, including numeric targets developed through comparison to peers
Data Processes	▪ There are some data weaknesses, such as data computed and entered manually	▪ There are some data weaknesses, such as inconsistent numbers between databases	▪ Preferably, data entered in a PMP should be rigorously defined and migrated from data systems (see *Task 4.8 Information Technology Systems Review and Disaster Recovery* for more details)
CI Approaches	▪ While there is not a DPW CI program, the City has many people trained in Lean techniques and routinely carries out root cause analysis (RCA) as part of asset management	▪ Engineering does not practice CI BMP by choice ▪ A continuous improvement program was not identified, and CI was not mentioned in the strategic plan	▪ CI is an important part of a PMP ▪ CI is the major mechanism by which improvements are made

Exhibit 4-14. Summary of City and County Practices - Performance Management and Continuous Improvement

Element	City	County	Comment
High-Level Review of PM&C			
Performance Management	▪ Many metrics are currently being computed ▪ Some limited CI techniques are being performed ▪ The City has personnel capable of implementing a PMP ▪ Opportunities for improvement include updating the strategic plan, more diverse metrics, use of a framework such as EUM or Baldrige, comparison to peers, best practice targets, improved data integrity and integrated CI	▪ Some metrics are being computed and tracked ▪ The County strategic plan calls for the implementation of a PMP this year ▪ The Bureau of Utilities is proposing to increase its metrics and add data definitions ▪ Opportunities for improvement include extracting DPW elements from the County strategic plan, more diverse metrics, use of a framework such as EUM or Baldrige, comparison to peers, best practice targets, improved data integrity and integrated CI	▪ No safety program metrics were identified (see *Task 4.4 Safety Programs and Risk Mitigation Planning* for more details) ▪ For data integrity issues, see *Task 4.8 Information Technology Systems Review and Disaster Recovery*
Inter-governmental Coordination	▪ We could not identify inter-governmental coordination of PMPs	▪ We could not identify inter-governmental coordination of PMPs	▪ For more information, see *Task 4.7 Inter-Jurisdictional Communication*
Exchange of Performance Management Information	▪ There is some sharing of information, but no sharing of performance management information	▪ There is some sharing of information, but no sharing of performance management information	▪ For more information, see *Task 5 Assess Meter to Cash Operations*

Findings

Baltimore City

Strategic Plan

- There is no strategic plan currently operative for water and wastewater operations only.
- A DPW strategic plan was developed in 2014 with consultant assistance. This was reportedly a very comprehensive process involving 100 internal stakeholders. We reviewed the 2016 update to the plan. The plan was intended to be reviewed and adjusted annually.
- The plan includes mission, vision and values and six goals.
- The planning framework was goal – objectives – strategy.
- The plan includes goal teams that review tactics and goals. Following the 2014 plan, goal teams met annually. However, they have not met in nearly two years.
- There were 19 measurable objectives (in the 2016 update) and one workplan objective (i.e., we will do this). Five had numeric targets. If we treat these 19 as performance measures, three were efficiency measures, and 16 were effectiveness measures. The strategic plan covered seven of the 10 EUM attributes.

- The strategic plan was an important element in DPW's AMWA Gold Award for Exceptional Utility Performance application. DPW was successful and received an AMWA Gold award. The format of the AMWA Gold application is based on the 10 EUM attributes.
- A major strategic plan update is needed, and the plan should include metrics.

Performance Management

- The Office of Strategy and Performance manages performance management except for anything that is the purview of the Customer Service & Support Division.
- The Office of Strategy and Performance collects data and assembles monthly performance metrics (plotting of KPIs, etc.) for review at monthly internal meetings. At those meetings, some process analysis is performed on low-performing areas (note: this is mostly RCA).
- Accuracy of data is considered to be lacking. This opinion came from both City and County sources. A discussion of the County problems with City work order information can be found in *Task 6 Review Field Operations*.
- The Bureau of the Budget and Management Research (BBMR) developed metrics with input from Bureau heads. BBMR also provides data definitions and sample calculations.
- We were provided a list of water and wastewater KPIs. These are metrics tracked at the Bureau and Division levels. They are not part of a DPW performance management program. These KPIs cover a broad range of activities within DPW:
  - Division Level – Environmental Services: 10 KPIs
  - Division Level – Wastewater Facilities: 9 KPIs
  - Division Level – Customer and Support Services: 13 KPIs (provide by a consultant to CSSD)
  - Division Level – Utility Maintenance: 6 KPIs
  - Division Level – Office of Asset Management: 5 KPIs
  - Division Level – Office of Compliance and Laboratories: 10 KPIs
- The KPIs are predominantly effectiveness measures and touch all but two of the EUM attributes.
- The Office of Asset Management puts out a monthly LOS and KPI report. This is one example (there are likely others) of a division-level performance management effort.
- There are no methods for setting performance targets that apply across water and wastewater activities. The chiefs set their own targets and definitions based on their judgment.
- Comparisons to others are currently not performed. There was one case years ago in which BG&E was looked at for comparison. Comparisons to peers is strongly recommended by Baldrige examiners and benchmarking professionals.
- Every service has service level agreements (SLAs), except for CSSD and services provided to the County. However, unlike SLAs used by other organizations, an SLA in Baltimore only means a commitment to producing a result in a certain amount of time. SLAs in Baltimore do not include a quality-of-service component.
- When there is underperformance, some root cause analysis is performed; if a target is deemed unrealistic, the target is adjusted (i.e., SLA is adjusted).
- Areas of high performance will trigger an SLA review, which may result in an adjustment to the time target.
- A balanced scorecard was developed as a vehicle for an annual report but any updates to the strategic plan were put on hold due to awaiting input from a new Director. While the 2017 AMWA Gold application utilized an effective utility management (EUM) framework, we could identify any further EUM analysis.

Continuous Improvement

- Personnel interviewed said there was no utility-wide CI program; however, there have been several ad hoc improvement efforts.
- As part of the last strategic plan, several DPW personnel were trained in Lean techniques with the idea of providing a CI team to divisions of DPW. As with everything else related to the strategic plan, this has been put on hold.
- High and low performance will trigger reviews of SLAs.
- Some RCA of areas of underperformance has been reported. The Office of Asset Management routinely performs RCA but only to identify problems, not as a CI effort.

Baltimore County

Strategic Plan

The Baltimore County strategic plan was developed in a comprehensive manner involving many stakeholders. The plan incorporates mission, vision and core values and utilizes a goal – strategy – activity – performance measure (key success factors) format. The strategic plan is widely viewed as a County level plan with limited applicability to utility operations. However, several paragraphs identify plan goals, strategies and activities applicable to water and sewer operations.

The County Sustainability goal is intended to "Ensure the long-term sustainability of the County's public and internal government infrastructure and safeguard the County's ecology and climate." The County also established an objective to "Enhance enforcement of laws, codes and regulations regarding buildings, property, fire, and safety and health."

To achieve its sustainability goal, the County has established FY 2020 strategies that, among other strategies, apply to water and sewer operations:

- Identify strategies and develop a plan for an asset management system (Note: The County recently contracted for an asset management system)
- Identify strategies to establish a sustainable capital maintenance and replacement program (Note: This would presumably be one product of the asset management system)
- Identify strategies and develop a climate change action plan (County goal is to reduce energy consumption by 50% by 2030)
- Procure a water/sewer end-to-end business review
- Procure a water rate study to identify and assess the equity and sustainability of water and wastewater operations
- Establish an Energy Performance initiative to assess energy usage within specific County buildings and identify best practices for improvement
- Identify strategies and establish a business process for the auditing and assessment of energy and water utilization within County buildings and facilities

To achieve its sustainability goal, the County has also established FY 2021 - FY 2023 strategies that, among other things, affect water and sewer operations:

- Implement an asset management system
- Execute, monitor and evaluate the stormwater management business process
- Implement the climate action plan
- Initiate an annual audit to assess energy and water utilization within buildings and facilities

The County has established a Government Accountability goal "to be open, transparent, accountable and a high-performing organization that effectively uses resources to provide high-quality services to residents

and visitors." A key County strategy is to "Improve internal and external customer service and satisfaction with the delivery of County services."

To achieve its Government Accountability goal, the County has, among other things, established strategies including "Ensure the long-term sustainability of the County's public and internal government infrastructure and safeguard the County's ecology and climate."

The County also established a key success factor to "Enhance enforcement of laws, codes and regulations regarding buildings, property, fire, and safety and health."

The County has outlined key success factors of "Increased efficiency in providing County services to residents" and "Better alignment of County resources to Strategic outcomes."

To achieve its Government Accountability goal, the County has developed, among others, the following strategies for FY 2020:

- Develop target responses times and standard procedures for all inquiry types within each agency
- Conduct a customer satisfaction survey to identify opportunities to enhance and improve customer experiences
- Launch the County's performance management program
- Continue department program reviews
- Develop key performance measurement indicators and launch quarterly strategic plan "Progress- to-Goal" sessions (Note: The Bureau of Utilities is planning a review of performance measures)
- Promote cross-department data sharing to accomplish strategic goals

Some of the County strategies to achieve the Government Accountability goal for FY 2021 - FY 2023 include:

- Identify legislative regulatory or policy solutions to facilitate better service delivery
- Create a continuous feedback loop to ensure a high standard of customer service delivery and adjust resources to meet demand
- Evaluate the on-call contracting process
- Maintain a regular schedule of Department performance measurements meetings and quarterly strategic plan "Progress-to-Goal" sessions

The County has established a goal for Workplace Empowerment, which is "Engage and empower County government employees to build a better Baltimore County." A key strategy is to "Review and enhance programs that promote employee safety and well-being." A key success factor is to "Decrease employee workplace injuries." The County also outlines a strategy to "Establish and promote a culture that encourages communication and collaboration across County staff and leadership."

Some of the strategies to achieve the Workplace Empowerment goal for FY 2020 include:

- Develop an inventory of existing wellness and safety programs and set best practice standards for safety and wellbeing across all agencies
- Identify common health and wellness challenges within the County workforce and individual agencies
- Evaluate and enhance the existing health and wellness plan, including the development of programs tailored to address common challenges
- Develop and implement an annual employee viewpoint survey
- Review, analyze and modify the current performance review process for effectiveness, quality and gaps with industry best practices
- Evaluate current County staff training initiatives and programs and identify needs and gaps
- Develop an inventory of existing wellness and safety programs and set best practice standards for safety and wellbeing across all agencies

- Identify and enhance the existing health and wellness challenges within the County workforce and individual agencies

Some of the County strategies to achieve the Workplace Empowerment goal for FY 2021 - FY 2023 include:

- Develop an employee health and wellness survey in partnership with the Benefits Office and ascertain where changes need to occur
- Set best practice standards for safety and wellness across all agencies
- Launch an annual training program for all managers and team leaders

Performance Management

The County's strategic plan calls for the following:

- Launch the County's performance management program
- Continue department program reviews
- Develop key performance measurement indicators and launch quarterly strategic plan "Progress-to-Goal" sessions
- Promote cross-department data sharing to accomplish strategic goals

DPW Bureau of Utilities

The Bureau of Utilities, which currently tracks 45 KPIs, is proposing an expanded performance management system consisting of more than 80 major KPIs and more than 40 subsidiary KPIs (for example, a primary KPI would be work order (WO) aging; subsidiary KPIs would be the various time intervals for work order completion such as 0-30 days, 31-60 days, etc.). Due to the nature of the work performed by the Bureau, the performance measures are predominantly effectiveness measures. The following is a summary of the major KPIs by category:

Administration

- Council requests
- Budget projections (OT hours)
- Out of service equipment
- Contract management (ten subsidiary)
- Assets maintained (three subsidiary)
- Asset management plan scheduling consent decree obligations and plans post consent decree obligations (linear feet inspected and cleaned per year, etc.)
- Work order aging by time open
- Inventory/storeroom (cycle checks, inventory accuracy, etc.)
- Technical quality complaint rate

Engineering and Regulation

- Number of significant industrial users (SIUs) and non-SIUs by category permits
- Dollars generated from industrial surcharges
- Number of overdue samples
- Number of permit violations
- Number of noncompliance SNC
- Number of waste hauler permits issued
- Dollar amount from Miss Utility invoices
- Number of grease inspections completed
- Number of grease violations referred to the Department of Health
- Number of lab samples completed by type
- Number of lab samples by equipment type

Pipeline Maintenance:

- Inspections – linear feet (by type, by equipment)
- Number of work orders for inspections
- Storm drain feet inspected
- Manholes (four subsidiary)
- Cleanings (12 subsidiary)
- Response time – disruption of service
- Time to address disruption
- SSOs (nine subsidiary + eight more)
- Miscellaneous (six subsidiary)

Construction:

- Active/open sewer work orders
- Time to close WO
- Time between temporary patch and permanent restore
- Number of active/open storm drain WO (+time to close)
- Number of WO involving coordination with City (+duration)
- Number of pipe segment requiring repeat repair within three years (three subsidiary)
- Number of steel plates installed and removed
- Collaboration with City (three subsidiary)
- Straight time hours worked on snow

Pumping:

- Number of open and closed pump station repairs per priority ranking per month
- Number of force main valves inspected
- Number of weekly inspections completed
- Number of weekly inspections missed
- Number of monthly and semi-annual inspections completed and missed (electrical and mechanical)
- Number of grinder pumps inspected and missed
- Number of grinder pump repairs completed and time to repair
- Number of wet wells cleaned and number missed
- Number of grinder alarms and time to respond to alarm
- Number of pump station alarms and time to respond
- Number of generator PMs
- Number of pump station SSOs
- Number of lawns mowed

The Bureau of Utilities is considering participating in AWWA benchmarking next year, allowing for a comparison of its performance to other high-performing water and sewer utilities.

Continuous Improvement

Achieving the County's strategic plan objectives for performance management should facilitate continuous improvement efforts. However, we could not identify a formal continuous improvement program.

Best Practices

Strategic Plan

Organizations should follow a well-developed, comprehensive plan that includes stakeholder input, KPIs, numerical targets and year-to-year improvement measures.

Performance Measurement Program (PMP)

A PMP is needed to implement the strategic plan. Characteristics of a good PMP include:

- Multiple measures to cover operations and strategic plan areas
- Comparison to others such as peer utilities and best performers out of industry; the Baldrige Award criteria emphasizes comparison to peers, and the benchmarking process includes identifying best practice performers for comparison
- Well defined data and consistent calculations for both self-comparisons (i.e., year over year improvement) and comparisons to others
- Regular reviews to track progress and perform continuous improvement
- A CI component to correct areas of underperformance, adjust targets and learn lessons from high-performing areas

High-Level Observations

Baltimore City

Strategic Plan

The 2014 Strategic Plan represents a good base to build on and offers several opportunities for improvement. Strengths of the plan include:

- It appears to have been developed comprehensively with 100 participants; however, only internal stakeholders were involved
- It included KPIs
- It spawned CI training
- It included the use of goal teams, which improve staff involvement and commitment

Opportunities for improvement in the strategic plan include:

- Include external stakeholders in the process
- Revise the form of the plan to be clearer to utility staff and to facilitate performance management; a goal-strategy-practices-measures approach should be considered in the next strategic planning effort
- Include more efficiency measures to balance out the high percentage of effectiveness measures
- Address all ten EUM attributes

Performance Management

The existing set of performance measures constitutes a good base from which to build a performance management system. The Office of Strategy and Performance is knowledgeable in performance management and CI and would be a good organizational location for such an activity. However, a high-performing performance management system would require the following:

- A new DPW strategic plan that includes robust KPIs
- A balanced set of performance measures; of the current high-level performance measures, there are less than a handful that are efficiency measures

- Set targets for the performance measures; there are some implied targets in the 66 performance measures identified above, but most just report on activities conducted (not a true performance measure)
- Establish peer groups so that the City can gauge how well it is performing relative to its peers; there are no comparisons to others (either within industry or out of industry) in the current performance measures
- Have regular reviews of performance that include actions for high or low performance
- Select a performance management reporting framework

High-performing utilities will incorporate 200+ performance measures in their performance management program and utilize around 70 performance measures for an annual performance review utilizing a framework such as EUM.

Continuous Improvement

The only evidence of a regular, continuous improvement (CI) effort was in the SLA adjustment process, recommended by the Mayor's Office of Sustainable Solutions (MOSS) and concurred by DPW. We identified examples of ad hoc CI efforts. Baltimore would benefit from a comprehensive approach to CI. Some approaches to consider would be process mapping (this would assist in knowledge management), RCA and use of Lean. The City has personnel trained in Lean techniques.

Baltimore County

Strategic Plan

The County's strategic plan encompasses the entire County. The strategic plan is not viewed as DPW specific as is evident in the lack of employee health and safety metrics at DPW and the fact that MBE/WBE (Minority Business Enterprise/Women's Business Enterprise) contracting was identified in the capital programs review as an area offering opportunities for improvement. However, the plan does include a substantial amount of guidance for water and sewer operations.

In addition to its perceived limited applicability directly to water and sewer operations, the strategic plan is more of a workplan (i.e., we will do this) than a strategic plan. There are only a few numeric targets. There are no comparisons to others. KPIs are almost entirely a year-over-year improvement.

Given all of the above, the plan calls for a performance management program, the development of KPIs and quarterly strategic plan "Progress to Goal" sessions. The County's strategic plan provides the direction needed for a robust performance management system. The Bureau of Utility's plans to increase KPIs could become the basis for an effective performance management program.

Performance Management Program and Continuous Improvement

Some parts of the County's plan have many elements of a performance management program – a set of metrics and KPIs with targets for some. The County's strategic plan calls for the development of a robust performance management program. The program should include a continuous improvement element with associated training. The County is considering a succession planning program that would incorporate process mapping. CI could be incorporated in process mapping.

City and County

Data Capture and Validation

Personnel in both the City and County expressed concerns about data accuracy. Manually entered data can be problematic. For example, if two field crews are looking at an SSO, one could see an SSO big enough to be reported to MDE, and the other could see one falling below the requirement to be reported. Manually entered data inherently involves judgment and carries with it some weakness.

There is some credence for data concerns:

- There is a large amount of manually entered and manually calculated data (City).
- City work orders (the basis for data utilized to compute important metrics) are reported to be rarely properly documented (noted by County personnel tasked with making sewer water use adjustments and finding City work order documentation inadequate).
- In developing metrics for other subtasks, we found instances of data variations depending on which report we were utilizing (County).
- One senior County employee we interviewed noted that the accuracy of available record drawings was not good.
- The County has no staff to access data.

Improving data capture and validation will require greater use of programs for data entry and reporting and the use of validity checks.

There are other areas of data capture and validity concern:

- Some important data is not available. For example, City crews working in the County do not have access to sewer GIS data (a City IT issue, not a County issue).
- Manually shared data is not updated on a timely basis. This was noted in the case of the Water Main List tables.
- Most importantly, we encountered numerous instances when we asked for key metrics and were told, “we have the data, but it will take a long time to get.” Data accessibility is an essential element of sound decision-making.

Simply put, important data needs to be:

- Accurately entered,
- Shared (when appropriate),
- Current, and
- Reviewed regularly

This is not the case with important data streams in both the City and County.

Data Analytics

The City performs some analysis of performance data in its reviews of metrics, which may result in an adjustment to SLAs. Some units in Baltimore County collect and review performance metrics. However, before a robust data analytics program can be developed, both jurisdictions will need:

- Direction from the strategic plan; the City is planning to update the DPW strategic plan; the County's strategic plan calls for the launching of a performance management program in 2020.
- Performance measures; both the City and County have a good base to build on.
- Data capture methods that will provide accurate data from which to compute performance measures.
- Regular reviews, including continuous improvement programs.

Task 4.7 Inter-Jurisdiction Communication

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review and provide observations on the overall communication processes and protocols between the City and County concerning various functional areas of the water system operations
- Provide, for each major functional area of operations, a summary of the key strengths, constraints, risks and issues concerning inter-jurisdiction communication and information exchange

Methodology

Our approach to this subtask was to recognize that there are two major elements to communications processes and protocols:

- Those required by the agreements between the City and County relating to the provision of utility services
- Specific communication processes and protocols required for effective utility operations at the functional level

For agreements defining communications processes and protocols between the City and County, we reviewed the agreements from 1972 (water) and 1974 (wastewater). For wastewater, we also reviewed communications related to the Wastewater Analyzer Office. Although it was not part of the 1974 agreement, it was implemented with the intent of mirroring the Water Analyzer Office, which was part of the 1972 agreement.

For communication processes and protocols required for effective utility operations, we selected the functional areas investigated by this study. To minimize duplication, see the other subtasks for communication processes and protocols related specifically to those subject matters.

This subtask focuses on the following functional areas:

- Management – compliance with City and County contracts
- Capital programs – planning, capital budgeting and capital projects
- Performance management and continuous improvement – sharing of performance management information
- Sewer capacity planning – wastewater capacity planning and consent decree coordination
- Field operations and customer complaints

Our approach to this subtask included:

- Identifying utility functional areas requiring communications and coordination
- Identifying mandated areas of communication and coordination
- Reviewing best practices gained from our experience in litigation involving IMAs (intermunicipal agreements), as well as experience with utilities that are successful at interregional communication and coordination and EUM attributes and keys to management success

In performing our analysis, we took a broad view of communications. Communications can include verbal, written and emailed communication as well as publicly available data, data transmitted between systems and information moving through various channels (complaints, surveys, etc.).

Sources of Inter-jurisdictional communication best practices include:

- Service Level Agreements – the 1972 Agreement, under which the City essentially becomes the water contract operator in the County, did not include any qualitative service level requirements. The

inclusion of SLAs in such agreements is a widely accepted best practice in such agreements. Examples can be found in several guidance documents.

- The National Clean Water Association's (NACWA) "Guidance Options, and Opportunities, for Public Clean Water Agencies in a COVID-19 World" (October 2020) recommends the following:
  - Define level of maintenance
  - Establish enforceable performance measures for non-revenue water management and reduction
  - Establish performance levels for work performed in the community
- The Reason Foundation's "Long-Term Contracting for Water and Wastewater Services" (Johnson et al., May 2002) provides guidance relative to partnerships: "success of partnerships depends on ongoing communications. Monitoring and oversight to ensure services contemplated by agreement are being delivered and problems and issues that arise will be identified and dealt with early on."
- The Effective Utility Management (EUM) Attributes and Keys to Management Success available at https://www.watereum.org/resources.

Other sources consulted include U.S. GAO's (Government Accountability Office) "Leading Practices in Collaboration Across Governments, Nonprofits, and the Private Sector," "Best Practices - Aren't" from Mike Myatt, Leadership (8/15/2012) and "Best Practices for Proactive Governance in Your City of County" from ICMA (International City/County Management Association) (7/17/2019).

Summary of City and County Practices

Exhibit 4-15. Best Practices – Inter-Jurisdiction Communication

Best Practice Area	Sub-Area	Performance	Comment
Service Level Agreement	▪ 1972 and 1974 agreements did not include SLAs	▪ Failure to establish key performance indicators, measure and monitor performance and communicate results has resulted in customer dissatisfaction and below-median performance	▪ In 1997, long-term (more than five years) contracts to operate the water and wastewater system became possible ▪ These long-term contracts required SLAs to protect the contracting agency
Conformance to Agreement Terms	▪ Analyzer offices ▪ Timing of information exchange	▪ The Water Analyzer Office is predominantly staffed by County personnel ▪ The Wastewater Analyzer Office stopped being co-located in 1993 ▪ Capital budgeting is a problem due to failure to meet agreed-upon deadlines	▪ The analyzer offices are key to the City-County relationship envisioned in the agreements ▪ Additional staffing in the analyzer offices will be required to conform with the intent of the agreements ▪ The County has been able to accommodate capital budgeting delays ▪ While collaboration on capital projects is better, some invoicing problems still exist

Exhibit 4-15. Best Practices – Inter-Jurisdiction Communication

Best Practice Area	Sub-Area	Performance	Comment
Monitoring and Oversight	▪ Measuring and monitoring performance ▪ Identifying and resolving problems ▪ Regulatory compliance (consent decrees)	▪ Neither the City nor County exchange performance information, resulting in below-median customer service and field operation performance ▪ Lack of transactional customer satisfaction surveys has resulted in County screening problem reports related to City services ▪ There have been problems in consent decree communications in the past, but there are now monthly information exchanges	▪ An SLA would identify key performance indicators, measure and monitor performance and the communication of results, resulting in improved performance over time ▪ Customer satisfaction surveys would have identified issues and problems earlier, likely resulting in improved problem resolution
Data sharing between systems	▪ Multiple systems exist that share data related to Field Operations activities and asset location	▪ Data sharing issues, such as systems that do not talk to each other and systems that cannot utilize data coming from the other jurisdiction's systems, are noted in the findings and observations of other subtasks	

Background

To assess what constitutes an appropriate level of communication and coordination, we need to identify the nature of the relationship between the City and the County. The case studies incorporated in *Task 4.9 Sewer Capacity Planning* provide the two ends of the spectrum of inter-jurisdictional agreements:

- Joint venture: the Upper Occoquan Sewage Authority (UOSA) is a good example. The four signatories to the agreement constitute the Board of Directors of UOSA. The members of the Board strive to make every decision unanimous. There are high levels of coordination and communication.
- Wholesaler-customer: in this type of arrangement (Los Angeles is a good example), the wholesale provider agrees to provide a service at a price. Barring failure to provide contracted services, the only communications required are price-related.

The relationship between the City and County falls midway on this spectrum. The City is a wholesaler and a contract operator, but the County is involved in planning and cost determinations through the Water Analyzer Office and the Wastewater Analyzer Office, as described in the next section.

Findings

City-County Agreements

In much of the United States, being a successful utility requires being successful at inter-jurisdictional communications and coordination. Water rights law and the economies of scale favor large water treatment facilities, most often resulting in urban centers providing treated water to growing suburbs. The Clean Water Act (CWA) of 1972 and the Construction Grants program resulted in large regional publicly owned treatment works (POTWs) serving regional areas. The mid-Atlantic region offers multiple

examples: the Blue Plains treatment plant, which serves many utilities in Maryland, DC and Virginia; the Washington Aqueduct, an Army Corps facility providing water to DC and several Northern Virginia utilities; and Baltimore City's water and sewer treatment plants which serve much of the greater Baltimore region.

In these regional situations, inter-jurisdictional communications and coordination are necessary to manage capacities, achieve regulatory compliance and satisfy customers. Under the Clean Water Act, POTWs are required to regulate dischargers. In these cases, agreements between utilities (intermunicipal agreements, formal contracts and other vehicles) define how this coordination and communication is to be carried out. However, the volume of litigation in this area indicates that developing good agreements is still an evolving art. Providing good service to customers requires, in most cases, effective informal communications at the working level.

Water

Under the 1972 agreement between Baltimore City and Baltimore County, the General Assembly of the State of Maryland determined that Baltimore City had a statutory obligation to provide water to the Metropolitan District of Baltimore County at cost and that the County had a corresponding obligation to pay the actual costs incurred by the City in the capital investment, the operation and maintenance and the management entailed in the provision of water to the County. This agreement also noted that the City supplies filtered water to portions of Anne Arundel and Howard Counties and raw water to portions of Carroll and Harford Counties. This agreement established the methods by which the capital and operating costs of the system would be allocated between the City and County, as well as establishing capital program responsibilities of the City and County.

The agreement identified various responsibilities:

- Each party to the agreement was to be responsible for the planning, design and construction of filtered water facilities within its boundaries, except as authorized by the Acts of the General Assembly. Each party contributing to the cost of filtered water facilities constructed by the other party was to have the right to review reports, plans and financing of the facilities.
- The planning, design and construction of all raw water facilities, raw water pipelines and treatment facilities was to be the responsibility of the City. The County was to have the right to review reports and plans of these facilities. The financing of these facilities, including the sharing of engineering and other costs, were to be the subject of future agreements.
- To plan for future increases in capacity of these facilities and construction of new facilities, the agreement called for the City and County to continue to maintain a jointly staffed office to make detailed studies of the Baltimore water system. Assigned personnel and associated costs were to be borne by the providing jurisdiction. All other costs for this office were to be allocated.
- This jointly staffed office became known as the Water Analyzer Office.

Wastewater

The 1974 agreement between Baltimore City and Baltimore County institutionalized the relationship between the two wastewater conveyance systems, cost-sharing arrangements and related matters. It also included a highly prescriptive communications protocol:

- By November 1 of each year, the directors of public works shall transmit flow projections. Based on this information, the respective directors of public works shall prepare six-year capital improvement programs.
- By January 15, the directors shall agree to the appropriate division of costs for jointly used facilities.
- Not later than July 1, the directors shall notify their counterparts of those system facilities that have been included in the officially adopted CIP.

Although the agreement did not specifically call for a Wastewater Analyzer Office, a Wastewater Analyzer Office was formed shortly after with the idea of performing for wastewater what the WAO was intended to do for water. The Office was originally located in the Abel Wolman Municipal Building and subsequently relocated to the second-floor offices of the Ashburton Water Filtration Plant to accommodate additional staff and field operations. Due to budget cuts, members of the office went back to their respective (City and County) offices in 1993. Budgeting for Office staff is still included in the respective departments; this staff carries out the analyzer operations through email.

Allocation of Responsibilities

Under the various agreements, the allocation of responsibilities for planning, design and construction are as follows:

Baltimore City

- Responsible for all water distribution system, and related, assets (pumps, storage, etc.) for both the City and County (Metropolitan District) except for those that solely benefit the County
- Responsible for all water treatment plants
- Responsible for wastewater conveyance systems within the City, including portions that accept County wastewater for conveyance to the City's wastewater treatment plants
- Responsible for all wastewater treatment plants

Baltimore County

- Responsible for water system components that benefit only the County
- Responsible for wastewater collection system and related assets within the County

Operational responsibilities mirror the above:

- The City is responsible for the operation of all assets within Baltimore City and the operation of the water system in Baltimore County
- The County is responsible for the operation of the wastewater conveyance system in Baltimore County

Management

Our observations related to compliance with City-County agreements relate to compliance with the operation of the WAO and WWAO and timetables in the agreement:

Analyzer Offices

The WAO, which is depicted as a joint effort in the 1972 agreement, is now predominantly staffed and run by County personnel. Although we did not identify complaints with the work products of this office, senior City personnel expressed concern about the lack of City participation. This one-sided staffing is also counter to an important objective of the 1972 agreement, which was to provide joint planning. The WWAO, which was intended to be a wastewater version of WAO, now operates in separate locations and communicates via email.

Timetables

There are exchanges of information, including the letters by directors informing their counterparts of system facilities that have been included in the officially adopted CIP. Both City and County approved capital budgets are available online. However, there have been problems in meeting the timetable. County personnel note that the City does not send out its capital budgets until they have been finalized, so County capital budgets tend to be one year behind. Other examples of timing-related problems are

presented in the next section. The prescribed timetable for wastewater is not being met due to problems on both sides.

Capital Programs

Inter-jurisdictional communications impact planning, capital budgeting and capital project execution.

Planning

- Baltimore City's latest master plan is dated 2006. The City has updated the State required master plan and anticipates submitting it to MDE in the spring. The City also has various other initiatives and plans which clearly lay out a plan for the future.
- Baltimore County has a master plan that it updates triennially. It is currently going through an update. There used to be a central system report that outlined future water work (a joint effort) that was intended to be prepared every ten years. It has been 17 years since the last report. This report was considered extremely useful for capital planning.
- The City independently plans and designs water capital facilities and then provides plans and costs to the County for review as required by the 1972 agreement. The City is aware of flows and population projections when it carries out its capital program. The City and County have quarterly meetings to discuss proposed projects and ongoing projects. While the City reported that it posts all of its information online and distributes it publicly, the County stated that it is usually, but not always, aware of what the City has coming up.
- There are informal communication channels that transmit planning information. The engineering departments of both the City and County discuss, either verbally or by email, system condition, needs for improvements and whether replacement or additions are needed. Communications remain this way until actual projects are defined. Once defined, a more formal approach is followed that consists of documenting the project narratively as well as cost. The information is then directed to the Water Analyzer Office to perform cost-sharing calculations based on prescribed analytical modeling. The information is returned to the engineering department for further review and discussion through email, verbal and in-person meetings. Once both parties are satisfied, the projects are directed back to the Water Analyzer Office for final cost-sharing calculations and returned to the engineering departments. An agreement letter is prepared by the originating director of public works to his/her counterpart identifying the agreed-upon project(s) for the upcoming budget year. The letter is signed and returned, signifying final approval for the project(s) to move forward.
- The analyzer offices are a vehicle for capital planning communication when they perform capital cost allocations. As previously indicated, when potential projects are identified, information is forwarded to the Water Analyzer Office for review and cost allocation calculations. Depending on the type of project, the analyst will perform calculations based on prescribed methodology as predicated in the 1972 and 1974 agreements. The results will be discussed verbally or electronically between the appropriate engineering departments of each municipality.

Capital Budgeting

While the level of communication is good, there is some room for improvement:

- The City communicates capital budget information; the County sometimes get preliminary budgets; the City does not send out capital budgets until they have been finalized, so the County capital budgets are always one year behind
- The City sends out emails for specific projects; the County replies pending approval
- Sometimes, the City will have small ticket items or emergency projects that require immediate mobilization of assets that the County will not be aware of

- In terms of capital budgeting, the Fullerton Filtration Plant has been a problem; the project is budgeted for a County contribution of $250 million; the County has set aside money in the past in their capital budget, but more pressing City needs have squeezed it out of the budget
- There is an exchange of DPW director letters that finalizes capital budgets; both County and City approved capital budgets are available online

Capital Projects

Once construction begins, there should be communications regarding cost and schedule, so the County is aware of project status and has budgeted appropriately to pay invoices from the City:

- The County (water) has quarterly meetings with the City on projects
- The County can attend project progress meetings
- There continue to be invoicing problems; County Engineering finds out about a problem when Metro sends the invoice back to them; this is usually the result of project delays (invoice arrives later than expected) or scope increases (invoice higher than expected); this initiates an exchange of emails which resolves the problem (in the case of high invoices, this may require the County agreeing to the higher amount); County personnel feel that they should receive earlier notifications of the situations that lead to bounced invoices (schedule delays, cost increases) so that they can make adjustments before the City sends out an invoice

Performance Management and Continuous Improvement

Since the City is essentially acting as a contract operator (water) in the County, it would be useful (although not contractually obligated) to report performance measures to the County. Neither the City nor the County exchange performance-related information.

Sewer Capacity Planning

Both the City and the County have consent decrees related to SSOs. The two consent decrees were negotiated separately, and time schedules are three years apart. For a variety of reasons, the U.S. Environmental Protection Agency prefers to negotiate consent decrees separately even where there are connected collection systems. As a result, the consent decrees do not discuss capital activity coordination, even though the County discharges to the City.

Early in the process, the City completed consent decree-required sewershed studies that resulted in an expected future boundary condition that assumed certain projects would be completed by the City to increase capacity to achieve that condition. Those boundary conditions were provided to the County for its modeling efforts for their consent decree required sewershed studies. The City projects were to be completed by 2019. Before completing those projects, the City opted to renegotiate their consent decree and complete the proposed headworks project as phase I of the new plan. Then, the City will complete phase II, which includes evaluating the effectiveness of the headworks project and determining what additional projects need to be completed. This means the future "boundary condition" that was provided to the County is no longer valid. The County believes that the City should have informed them as a major stakeholder in the City system and WWTPs. The Chief of the County Bureau of Utilities and the acting Head of the City Bureau of Water and Wastewater have recently begun a new round of monthly meetings to reestablish communications. There have been, and continue to be, many changes in leadership in the City and County, so staff will be working together to establish consistent communication during these transitions. This process is in its infancy, so the effectiveness has yet to be determined. More information on consent decree communication can be found in *Task 4.9 Sewer Capacity Planning*.

Field Operations and Customer Complaints

Per the 1972 Agreement, the City owns and operates the water system in Baltimore County. Since this agreement did not contain target service levels, there is no contractual requirement for the City to provide data regarding quality of service. There is some service-related information that passes between the City and County (described later).

As the water infrastructure has aged, the City's fieldwork has become more reactive and less planned. The City estimates that fieldwork is now 70% reactive (some interviewed thought it was higher). High levels of reactive work have several consequences:

- A high level of requests for work results in the need to triage with more serious problems being dealt with first.
- Continued triage results in lower-level problems going unaddressed, sometimes for months (or longer).
- Work going unaddressed for months results in customer dissatisfaction, resulting in more complaints to 311 (in the first half of 2020, about 80% of calls were repeat calls).
- Even small problems, if unaddressed, can become big problems. A leak on Fisher Street went unaddressed for six months, threatening a road collapse.

About five years ago, County residents began complaining about the lack of responsiveness on the part of the City (e.g., calls not answered, work not getting done, etc.). Since the County has a vested interest in water consumption (it is the basis of sewer charges), the County hired personnel to conduct investigations and send all findings to the City (see *Task 6 Review Field Operations*). The County inspectors investigate, correct minor issues that they can handle and send findings to the City, with detailed instructions on what is needed to correct the issue at hand, as well as instructions on what to correct about anything the current issue affects (e.g., billing, leak reports, proper account information). The County (Metro) finds these reports to be more reliable than the City reports in determining whether to adjust a sewer service charge or not. To ensure that the County inspectors could produce reports useful to the City, they hired one of the City's inspectors with 20+ years of experience, who optimized the crew sizing and stocking of the inspection truck.

The process for handling customer complaints within the County water system is described in *Task 6 Review Field Operations*. The following summarizes key points related to inter-jurisdictional communications:

- County water customer complaints regarding leaks and water main breaks, including breaks causing damage to roads and property, are instructed to call the County (per County website).
- The County sends out an inspector to investigate.
- The investigator writes a report, which is always provided to the City.
- The City, having received the report, sends out its own inspector and relies on its inspector's report to determine future actions.
- When the City is ready to send a crew out, they will contact the County so that there can be a County crew available with a dump truck to haul spoils and other actions that may be required from them. However, in an estimated 10-15% of the cases, the City does not inform the County that a crew is coming out.
- A best practice in field operations is to check to see if anyone else is working in the area. The City relies on email communication to know if someone is working in a given area. For example, Wachs Water Services (a distribution system contractor) sends activity information via email and County Engineering sends out CIP contractor lists. There are several breakdowns in this system, such as too many emails and the County informing the City's Office of Asset Management but not sharing with

the City's utility maintenance crews. As a result, field crews are not always aware of others working in the area.

- Another best practice when performing fieldwork is to be aware of infrastructure in the immediate area. The City can access water infrastructure in GIS. However, the City utility maintenance crews cannot access sewer infrastructure in the County because the two main computer applications that the Division uses to access GIS data (UView and Cityworks) are not currently configured to access County sewers. It should be noted that the City DPW's central GIS operation has access to the County's sewer layer (this was confirmed by the County) even though there is no process in place to regularly update these files (the County noted that the layers the City sees might be out of date).
- The "Water Main" list, which is generated by operations staff in the City's Utility Maintenance Division, is sent out multiple times each day and identifies the status of each main where the repair crew will be working. The report identifies the location of the main break, size of main, number of services affected, number of hydrants affected, major facilities affected, date and time reported, crew assigned and status.
- County personnel note that the Water Main list is useful but not always kept up to date. The information on the list can be incorrect if the City must deal with a more serious problem (see below).
- The Chief of the City Utility Maintenance Division has four supervisors who prepare lists indicating where work will be performed, but crews can get redirected by emergencies resulting in the Water Main list not always being current.
- When staff from the City Utility Maintenance Division works in the County, they consider it a joint City-County effort, so typically, the City Utility Maintenance Division does not report complaint status or completion to the County, relying on the County crew to be aware of completion. By reviewing the Water Main list regularly, the County can identify status from the City's standpoint. Since a water main break repair requires County crews for backfilling and pavement restoration to be fully complete, the County knows the City's work is complete by receiving such a request either from the City or from a County homeowner.

Best Practices

The project team researched best practices, which were then used in reviewing City and County practices and then in developing high-level observations. What follows is a summary of Inter-jurisdictional best practices, as compiled from the sources cited in the methodology section.

Inter-jurisdictional (and intra-jurisdictional) communications between the County and City enjoy a similar relationship. The nature of their communication has changed over time. The County and City use different software applications, which can mask redundancies.

Written Guidance and Agreements

- Written agreements are dynamic and up to date, not historical documents that are little known.

Defining and articulating a common outcome

- Outcomes are clearly defined. With the 1972 water agreement, the 1974 sewer agreement, compliance decrees and changed regulations, the "common outcome" is not constant.
- Data is integrated and well managed.
- Organizations make effective use of data from automated and smart systems and learn from performance monitoring.
- Jurisdictions agree on a common set of facts.

Bridging Organizational Cultures

- Over time as the missions of each entity change, each entity keeps its own culture in sync with the other. There is clear responsibility to ensure that the cultures are compatible.
- There is clear responsibility to ensure utility leadership and staff work together internally and coordinate with external partners to anticipate, respond to and avoid problems.

Coordination

- Repair efforts are coordinated within the community to minimize disruptions.
- The jurisdictions work together with staff internally and coordinate with external partners to anticipate and avoid problems.

Leadership

- Leadership is sustained, and new leadership agrees on common outcomes.
- The organization structure allows for change.
- Leadership adapts to changing demands. The organization processes, understands and responds to new engagement techniques.

Clarity of Responsibility/Authority

- Those responsible for a function have the authority to execute that function. If collaboration is required, roles are defined, and processes are in place and followed.
- There is a positive process for responding to feedback (e.g., social media, online forums, virtual town halls, etc.), and there is continuous capacity to do so.
- Processes are well documented, i.e., "this is how we do things." Standard operating procedures are regularly updated, creating shared knowledge.

Participants

- Staff that are required for the success of a project or objective have been assembled.
- New participants are involved as needed.
- Colleagues and partners are invited in and shown appreciation.

Resources

- If each party of an agreement makes annual financial contributions, there is a defined mutually agreed-upon process to define the appropriate contributions.
- As appropriate, offices are co-located, and training is shared.

High-Level Observations

Strengths

- Although it could be improved, the system works, albeit mostly through informal channels.

Constraints

- Failure to adhere to capital budget development timelines results in suboptimal County capital budgets.
- Important City and County systems (e.g., Cityworks) are not linked. Once these systems are linked, field operations coordination will be improved.
- The inability of City field trucks to see County sewers in GIS is a constraint on City field activity in the County. This is a City problem that should be solvable.

- The City's high percentage of reactive fieldwork has produced a situation with duplicate activities, communications that are ignored and other undesirable situations. This cannot be corrected until City approaches its target of work order distribution of 40% planned, 40% predictive and 20% reactive.
- County residents cannot create a service request online.
- Understaffing of the analyzer offices is a concern for both the City and County. Senior City officials expressed concerns that this is staffed predominantly by County personnel.
- There are limited funds as infrastructure ages and demands more money for renewal and rehabilitation.
- There are two separate billing systems.

Risks

- The combination of highly reactive fieldwork by the County and poor City-County communications has allowed small problems to escalate into serious situations (e.g., Fisher Street leak). High levels of reactive work pose an infrastructure risk
- Poor communications have resulted in high customer dissatisfaction levels. The reaction to this dissatisfaction has resulted in suboptimal service delivery. Highly dissatisfied customers pose a political risk.
- The limited lines of communication between the City and County have produced some surprise invoices to the County, creating budget risks.

Issues

- Pending retirements at County level
- High turnover of City staff
- Lack of trust in the City to be responsive on the part of County customers
- Lack of quantitative or qualitative service level measures for the City services provided to County customers
- Limited recent history of effective communication and coordination on key issues
- Lack of communication channel for long term water problems in the County (unaddressed leaks)

Overall Observations

Agreement

The agreements that define the communication processes and protocols between the City and County are approaching 50 years of age. Many IMAs would have been updated and revised over that period. The 1985 Blue Plains IMA, for example, has been revised at least three times. As many things have changed since the 1970s (demographics, regulations, technology, etc.), an improved set of agreements should be possible. The best practice questions presented above would serve as useful guidelines in updating these agreements.

Analyzer Functions

The two analyzer offices were a key ingredient in the desired positioning of the City-County relationship. They are not functioning as originally envisioned. As part of an updated agreement, the City and County should pursue a methodology that ensures the two entities work cooperatively and plan jointly for the future.

Technology

The technologies employed in utility operations have gone through a significant evolution in the past 50 years. The agreements of the 1970s never envisioned the current role of technology in the operation of

today's utility. Any updated agreement(s) should include a commitment to update the technologies utilized by the City and County, both internal technologies and those involved in data sharing between the two jurisdictions.

Effective Utilities

Effective communication between utilities is essential and requires a continuing commitment from the top leadership in each organization. Each utility should evaluate the functions and processes involved in inter-jurisdictional communications and take action to ensure they are effectively implemented.

Task 4.8 Information Technology (IT) Systems Review and Disaster Recovery

Scope

The project team was requested to perform the following scope of services for this subtask:

- Provide an inventory of the major IT systems that the City relies on in the delivery of water services within the City and County jurisdictions, including a description of the IT systems, their respective purposes, the year of implementation, the sphere of impact in the provision of services and any system inter-dependencies
- As part of the inventory of IT systems, include key functional areas such as "Meter to Cash" operations, Customer Service, Field Operations, and various other operational areas of water utility system
- Review and summarize the IT systems' disaster recovery processes and protocols for aspects including data and information storage, information recovery and continuity of operations (COOP)

Methodology

The project team compiled a list of stakeholders to identify key participants for both the County and City for data requests and discovery sessions. Using this list, the team collaborated to identify the appropriate participants for each subtask-based discussion. Ultimately, the project team arrived at an ample inventory of personnel representing County and City departments that would need to participate in each subtask's process topic. The list of stakeholders was analyzed to understand the personnel and their agency and their participation in each process for each subtask. This list served as the foundation of the outreach plan. The list was reviewed, validated and updated as necessary to identify changes within the staff and roles and responsibilities.

Extensive data and information requests were submitted to both the City and County stakeholders as a first step in the analysis. The data requested was specific to data retention, disaster recovery processes and protocols, information recovery and COOP.

The following is a list of initial documentation requested to facilitate the review:

- Current/existing continuity and disaster recovery plans related to the delivery of water services
- Existing City/County data retention policies
- Existing inventory of IT systems that the City relies on for the delivery of water services within the City and County
- Existing list of assets, asset name, asset description, assent owner, users, department, physical locations, network locations, format/file type, related application and inter-dependencies

The discovery sessions were planned with both County and City staff, and pre-defined questions were sent out ahead of time for review by the participants. In-person discovery sessions were planned but could not be conducted due to COVID-19. All discovery sessions were conducted through a series of interactive virtual online sessions and emails throughout the review with DPW, Baltimore City Office of Information Technology (BCIT) and the County.

The workplan also included analysis to measure critical IT systems against industry standards and best practices.

IT System Inventory

The following exhibit represents an inventory of the major IT systems that the City relies on in the delivery of water services in the City and County.

Exhibit 4-16. IT System Inventory

IT System	Purpose	Year Implemented	Owned By	Infrastructure Managed By	Sphere of Impact	Inter-Dependencies
Cityworks Asset Management System (AMS) / Work Order Management System	Tracks work activities and asset management	2004	DPW	BCIT	▪ If Cityworks goes down, the flow of work retrieval and assignments would be affected ▪ Different groups/offices are set up to go to their respective inboxes to retrieve records ▪ Besides work retrieval, assignments and abatement, proactive criticality and condition assessments of assets are affected, as well as where work orders and inspections are created early to identify and mitigate possible issues before any reported failure	▪ Cityworks is integrated with 311 (Salesforce) ▪ The citizen service requests generated at 311 are received in Cityworks and correspondingly abated
Water Billing System (UMAX)	Manage customer service billing operation for City DPW	2016	BCIT	BCIT	▪ The system is on-premise only, which puts it a great risk in the event of a disaster ▪ If the system goes down, the City cannot bill water services	▪ The data from meter reading for County billing comes from Itron meter reading software MV-RS ▪ If MV-RS (Multi Vendor Reading System) goes down or there is no meter reading, bills cannot be generated

Exhibit 4-16. IT System Inventory

IT System	Purpose	Year Implemented	Owned By	Infrastructure Managed By	Sphere of Impact	Inter-Dependencies
Legacy Water Billing System	Bills water services for County customers	1980	BCIT	BCIT	▪ The legacy water billing system is a mainframe application and therefore is not directly impacted in the event of a disaster or ransomware attack ▪ System downtime is minimal	▪ If MV-RS goes down or there is no meter reading, bills cannot be generated. ▪ Additionally, output from the mainframe goes to SQL for reporting and is used for information purposes
Salesforce 311	Public submission of information related to reporting a problem, requesting a service or asking a question	2015	BCIT	BCIT	▪ Salesforce is web-based and therefore is not impacted by ransomware attacks ▪ System downtime only occurs when the internet is unavailable	▪ Salesforce 311 is integrated with Cityworks ▪ The citizen service requests generated at 311 are received in Cityworks and correspondingly abated ▪ Once closed in Cityworks, the request is auto-closed in 311

Ransomware Attack

On May 7th, 2019, hackers digitally seized approximately 10,000 Baltimore government computers infected with an aggressive ransomware variant, RobinHood, which crept under firewalls, crippling critical City systems. RobinHood made it impossible to access servers without a “digital key” that only the hackers possessed. As ransom for the key, the hackers demanded payment of three bitcoins per system to be unlocked. The hackers also stated that the ransom would be increased if not paid within four days and that the information would be permanently lost if the ransom were not delivered in ten days. The City government refused to pay. Email systems and payment platforms remained offline, costing the City an estimated $8 million in unpaid water bills and an additional $10 million in other costs. City employees were locked out of their email accounts, and citizens could not access essential services, including websites utilized to pay their water bills. The attack had a devastating impact, affecting employee access to critical systems for billing, customer service systems for handling and tracking inquiries and internal emails.

FINDINGS

CITYWORKS

Cityworks was recently upgraded to a new version (15.5.5), including an upgrade of associated infrastructures. A 2019 Windows Server is used for the application server and is regularly patched per BCIT standards. Additionally, the Cityworks database resides on 2016 High Availability Microsoft SQL (structured query language) server, which is managed by the BCIT DBA (Database Administration) team. The database is frequently backed up to a local site, as well as to the cloud.

Cityworks is currently integrated with Salesforce 311. Citizen service requests related to water and wastewater are created in 311 and transferred to Cityworks where work orders are created to abate the issues. When a work order is completed and closed in Cityworks, the corresponding citizen service requests in Salesforce 311 are auto-closed.

If Cityworks goes down, the workflow of work order retrieval and assignments would be affected. Different groups/offices are set up to go to their respective inboxes to retrieve records. Besides the work retrieval, assignments and abatement, proactive criticality and condition assessments of assets are affected as well. Work orders and inspections are created early to identify and mitigate possible issues before any reported failure.

Regarding security, all DPW servers have been upgraded to be within support from Microsoft (Server 2012 R2 and above). There have also been no reported exceptions to the patching policy, and monthly security updates are applied to all systems related to UMAX water billing as well as meter reading. Systems are regularly scanned from the outside and internally and work to remediate any critical vulnerabilities with high urgency. Aside from patching, the servers are reviewed to disable unnecessary services, password policy and auditing, as well as having antivirus/endpoint protection that is regularly updated with definitions.

Daily database backups are performed by BCIT. One backup is stored locally, and another is stored in a secured cloud. If systems fail locally, new servers are to be built, and the data would be restored from the backup. Local replication of databases exists; if one fails, another will take over, but there are no true failovers. If a system failure occurs, there is no standby equipment to automatically take over. According to DPW, the BCIT is currently working on a proposal for failover.

SALESFORCE 311

Salesforce 311 is the intake for everything related to City services that are non-emergency. It is a public-facing web-based application. Customer service requests are opened in Salesforce 311, and, depending upon the issue, notification is sent to Cityworks, where a work order is opened for review and abatement. Once the work order is resolved and closed out in Cityworks, notification is sent back to Salesforce 311 to auto-close the customer service request.

For water-related issues, Salesforce 311 has been utilized for five years. Previously, Motorola was used for about 15 years. Salesforce 311 is web-based, so the ransomware attack did not affect the system, and it did not impact service requests to Cityworks.

There are two CRM (customer relationship management) administrators responsible for any changes, enhancements or configuration of the system.

COVID-19 did not negatively impact service as remote workers had internet connectivity and could still service customers.

Legacy Water Billing System

BCIT indicates sufficient resources are supporting the mainframe. Support consists of the BCIT team of two and additional support that is outsourced to Blue Hill Data. If one of the BCIT team leaves, Blue Hill will backfill with one of their employees.

BCIT indicates they are not aware of what is going on with the outsourcing of the meter shop. Itron reads the meters, but BCIT is not sure of the planned changes.

BCIT indicates the legacy water billing system is sustainable. There was discussion about moving the County billing from the legacy water billing system to the UMAX City platform, but BCIT indicates the County did not want to migrate.

BCIT indicates there is minimal, if any, downtime for the legacy water billing system.

BCIT has documented backup plans. The mainframe is in New York, and the backup site is in New Jersey. Code and data are copied from New York to New Jersey nightly.

UMAX

UMAX downtime is minimal. Resiliency would be limited to restoring from daily backups along with transaction logs. UMAX is on-premises only.

Best Practices

The workplan included performing best practice analysis by reviewing the people, policies and processes and the technology associated with critical IT systems against industry standards and best practices such as DR/ISCP (disaster recovery/information system contingency plan) reviews, architecture reviews, infrastructure vulnerability assessments, access control assessment and off-site and cloud-based data center/storage assessment. Based on the analysis, the team would identify industry best practices, measure against current processes and policies to identify gaps and provide recommendations for both continuity of operations and disaster recovery by using; NIST (National Institute of Standards and Technology), FISMA (Federal Information Security Management Act), NRF (National Response Framework), NIMS (National Incident Management System), MEMA (Maryland Emergency Management Agency), and EPA. Documentation to conduct this analysis was requested from both the City and the County but was not received. As a result, a best practice deep dive could not be conducted. Although a detailed comparison could not be included in this report, further research should be conducted to ensure best practices and standards are being followed for each system. Examples of best practices and standards are notated below:

Exhibit 4-17. IT Systems Best Practices and Standards

Description	Best Practice/ Standard	Resource	Comment
Develop a Contingency Planning Policy Statement	Best Practice	National Institute of Standards and Technology	▪ A formal department or agency policy provides the authority and guidance necessary to develop a contingency plan

Exhibit 4-17. IT Systems Best Practices and Standards

Description	Best Practice/ Standard	Resource	Comment
Conduct Business Impact Analysis (BIA)	Best Practice	National Institute of Standards and Technology	▪ Helps identify and prioritize critical IT systems and components
Identify Preventative Controls	Best Practice	National Institute of Standards and Technology	▪ Measures taken to reduce the effects of system disruptions can increase system availability
Develop Recovery Strategies	Best Practice	National Institute of Standards and Technology	▪ Ensures the system may be recovered quickly and effectively following a disruption
Develop an IT Contingency Plan	Best Practice	National Institute of Standards and Technology	▪ Should contain detailed guidance and procedures for restoring a damaged system
Plan Testing, Training and Exercises	Best Practice	National Institute of Standards and Technology	▪ Identifies planning gaps, whereas training prepares recovery personnel for plan activation; both activities improve plan effectiveness and overall agency preparedness
Plan Maintenance	Best Practice	National Institute of Standards and Technology	▪ Living document that is updated regularly to remain current with all system enhancements
NIST Compliance	Standard	National Institute of Standards and Technology	▪ Identify systems that contain Controlled Technical Information / Controlled Unclassified Information (CTI/CUI) review central file shares, endpoints, mail servers and any systems where files may be shared, stored or transferred
NIST Compliance	Standard	National Institute of Standards and Technology	▪ Categorize files and separate CTI/CUI information and label
NIST Compliance	Standard	National Institute of Standards and Technology	▪ Limit Access to CTI/CUI data to only personnel who are authorized
NIST Compliance	Standard	National Institute of Standards and Technology	▪ Monitor all systems that have CTI/CUI information. Keep log of who accesses the system and when ▪ Ensure the logs are accurate, complete and preserved for a sufficient duration
FISMA Compliance	Standard	Federal Information Security Modernization Act	▪ Document every security system, outline relationships between systems and any other systems within the network
FISMA Compliance	Standard	Federal Information Security Modernization Act	▪ Categorize information systems
FISMA Compliance	Standard	Federal Information Security Modernization Act	▪ Have a system security plan that is periodically reviewed and updated and includes information about security policies, procedures and security controls

Exhibit 4-17. IT Systems Best Practices and Standards

Description	Best Practice/ Standard	Resource	Comment
FISMA Compliance	Standard	Federal Information Security Modernization Act	▪ Perform regular risk assessments to pinpoint risk at organizational level, business process level and information system level

High-Level Observations

- Additional best practice analysis should be completed to ensure proper protocols and procedures are in place to protect the systems and data related to the legacy water billing system, UMAX, Cityworks and Salesforce 311.
- There does not seem to be overarching governance or clear delineation between system ownership and the area that manages the infrastructure of each IT system. The County struggles to understand "who is responsible for what" in terms of IT systems used and owned by the City.
- Communication improvements are necessary for the integrated processes to be entirely successful. The agreements that define the communication processes and protocols between the City and County were executed in the 1970s and should be revisited jointly by both parties and updated.
- Verbal communication from the City indicates that IT systems supporting water services are protected from a disaster recovery and COOP perspective. However, no documentation has been provided to the County to confirm the accuracy of that position.
- Cityworks is adequately protected in the aftermath of the ransomware attack and is adequately staffed with five resources to provide technical support.
- Salesforce 311 is stable and adequately protected and is sufficiently staffed with two CRM administrators to manage all changes and configuration.
- The ransomware attack did not have any impact on Salesforce 311 and did not cause service interruptions.
- COVID-19 had minimal impact on service levels of Salesforce 311 as remote workers have internet connectivity and, therefore, could service customers without interruption.
- To mitigate disaster recovery concerns related to the UMAX system, a second data center in another geographical location or the cloud should be considered to maintain operations in the event of a disaster. BCIT has started the planning phase and is gathering requirements to make this happen. No target date has been established.
- MV-RS (Multi Vendor Reading System) is old and should be migrated to a new version of Itron.
- The ransomware attack did not directly impact the legacy water billing system.
- BCIT indicates the County did not want to migrate to UMAX. The County indicates they are interested in moving from the legacy water billing system to UMAX. Before migrating, the impacts on County billing needs to be understood; to date, communication related to those impacts has not been addressed.
- County billing relies on Itron's MV-RS for data collection of meter data and mobile route management. If MV-RS goes down, bills cannot be generated.
- The original configuration in UMAX was incorrect to properly handle two dial meters and battery meters. This should be corrected before the County migrates to UMAX. Further evaluation should be conducted to determine the best path forward for County billing.
- Neither the City nor County could provide actual policy or procedural documentation surrounding disaster recovery for any of the IT systems supporting water services. Verbal communication indicated

policies and procedures exist, but ownership of who could provide such documentation was a hindrance.

Task 4.9 Sewer Capacity Planning

Scope

The City and County have distinct consent decrees for SSOs, and hence sewer capacity planning is of critical importance. The project team was requested to perform the following scope of services for this subtask:

- Review and summarize the existing sewer capacity planning processes in the City and the County
- Review and summarize the existing sewer capacity agreements between the City and the County
- Review and provide objective observations on the existing processes
- Benchmark City and County inter-governmental coordination with various models of multi-jurisdictional planning best practices, along with examples of case studies, where feasible

Methodology

A comprehensive request for information and data was provided to Baltimore City and Baltimore County as a first step in the analysis. Among the documents requested and reviewed was the *Baltimore City and Baltimore County Metropolitan District Sewer System Agreement* that was made in March 1974.
In addition to the 1974 agreement, other documents reviewed included:

- Consent Decree, dated 04/22/2002
- Consent Decree, dated 07/22/2005
- Modified Consent Decree Calendar Quarterly Report- Baltimore City Department of Public Works, Calendar Quarterly Report NO. 10 for Calendar Quarter ending March 31, 2020
- Maryland Reported Sewer Overflow Database, reported to MDE starting January 2005
- Reported Sanitary Sewer Overflows 2012-2020
- Modified Consent Decree Public Information Session Summary, January 23, 2020
- Capacity, Management, Operation and Maintenance (CMOM) Manual, Howard County Department of Public Works Bureau of Utilities, updated December 2010
- Modified Consent Decree Public Information Summary, January 23, 2018
- Baltimore County and Baltimore County Sewer Design Guidelines
- WSSC Design Criteria for Sewer Systems, 2008
- Howard County Design Manual, Water-Sewer, 2016
- Interviews with DPW officials

To benchmark City and County inter-governmental coordination with various models of multi-jurisdictional planning best practices (which included capacity planning), along with examples of case studies, where feasible, we identified a spectrum of similar multi-jurisdictional arrangements, distributed a questionnaire, interviewed representatives of participants in each arrangement and gathered intermunicipal agreements (IMAs) for half of our sample. Our sample included:

- Upper Occoquan Service Authority (UOSA), VA
- Los Angeles Bureau of Sanitation
- Massachusetts Water Resource Authority (MWRA)
- King County, WA Wastewater Treatment Division
- Blue Plains (DC Water)
- City of Wilmington/New Castle County, DE

Interviews were conducted with City and County staff as well and the representatives of the organizations listed above.

Summary of Best Practices

Exhibit 4-18. Best Practices and Case Studies - Sewer Capacity Planning

Best Practice	Case Study Insights	Comment
Update Agreements When Circumstances Change	▪ Successful case study IMAs are updated regularly to reflect changes ▪ IMAs that are slow to reflect changes have a history of litigation and/or disputes	▪ The agreement governing the City and County's coordination is approaching 50 years ▪ There have been many operational changes during that time, and participants we interviewed opined that updates are needed to incorporate new developments in the agreement
Transparency in Communicating Cost Information	▪ This is a best practice generally in inter-jurisdictional agreements ▪ It has been a problem with some of our case study agreements	▪ Problems have more to do with the timing of sharing information (see *Task 4.7 Inter-Jurisdiction Communications*) ▪ A Wastewater Analyzer Office, operating as originally intended, would minimize this as a problem
Good Communications in Usage and Capacity Tracking	▪ The well-functioning case study agreements devote a great deal of effort to monitoring flows and tracking capacity utilization	▪ A Wastewater Analyzer Office, operating as originally intended, would minimize this as a problem
Provide Forums for Sharing of Information that Allow for Inputs from Dischargers	▪ This is a common factor in the case study systems that seem to be working well	▪ Information sharing and coordination is improving and projected to get better ▪ There are monthly meetings and an annual meeting, which results in an annual wastewater report

Findings

Review of the existing sewer system agreements

The sewer system agreement dated March 1974 between Baltimore City and Baltimore County Metropolitan District is in effect as of today. The following is the summary of the requirements per this agreement:

- Each party contributing to the cost of the sewerage system shall have the right to review and approve reports, plans, bids and financing of any related construction by the other party. Any costs associated with the review shall be borne exclusively by the reviewing party.
- The agreement applies to the service areas of Back River WWTP and Patapsco WWTP.
- Each party to the agreement shall permit the other party to discharge sewage to its sanitary sewers by allowing the other party to connect its sewers only at the designated points.
- The directors of public works of the respective parties shall transmit to their counterparts, not later than November 1 of each year, projections of flow from their subdivisions to the other point of entry. Based on said criteria, the respective directors of public works shall prepare a six-year capital improvement program designated to accommodate the flows from one system into the others, together with those facilities required to handle the estimated flows within the respective subdivision.
- By January 15 of each year, the directors shall agree to the appropriate division of costs of such jointly used facilities, based on the design flow method.

- No later than July 1 of each year, the directors shall notify their counterparts of the facilities that have officially been included in the capital improvement program and shall also provide the estimated flow data at each point of entry and estimated capacities to be made available at the other party's system upon completion of such improvements.
- The number of connections and flow rates shall be agreed upon by both parties.
- Each party shall be notified in writing at least five days before making any connections to its sewerage system by the other party to permit the inspection of construction of said connections.
- Each party shall contribute its proportionate share of all costs for planning, designing and execution of any repair or rehabilitation in the jointly-used facilities, including sewers, pump stations and treatment facilities. The costs shall be proportioned according to the volumetric method using the quantities of sewage contributed by both parties.

Review of the existing sewer capacity planning processes

Baltimore City

To better understand the sewer capacity planning process and adherence to the guidelines of the March 1974 Agreement, a virtual meeting with the high-level officials of the City and County was conducted. These officials are involved in the sewer capacity planning and coordination, hydraulic modeling and consent decree coordination and compliance.

Based on the discussions in the interview, the following viewpoints were presented by the officials:

- The 1974 sewer system agreement is still in effect. However, updates to this agreement are needed to incorporate new developments.
- Sewer capacity planning is a joint effort by Baltimore City and Baltimore County to allocate the flows entering the sewer system from both jurisdictions, plan for future upgrades, prioritize the capital improvement projects and new developments and update the sewer system operation and maintenance requirements. The City and County have separate sewer service areas. However, operation and maintenance of the wastewater pumping stations and wastewater treatment facilities is provided by Baltimore City.
- On an annual basis, the proposed projects for sewer system upgrades/repairs/rehabilitation are prepared by the County and submitted to the City for review.
- The City receives plans and permit applications for all new development proposed in the City and County. Based on the findings for impacts to the sewer infrastructure, the City may elect to include conditions and costs to address impacts to the sanitary sewer system. The projects are prioritized, put on hold or rejected. Regular meetings are also held between the City and County throughout the year to approve emergency SSO projects and priorities.
- The Baltimore County sewer system is connected to the City sewer system. There are flow metering equipment and flumes installed at the connection points. Flow monitoring is performed by the City.
- The improvements in sewer basins are prioritized based on the recorded SSOs, projected flows and age of the system components (pipelines, pump stations, wastewater treatment system). Additionally, short-term sewer repairs/replacements/cleanings are performed based on customer complaints and other emergency conditions in the sewer system.
- The peak dry-weather flows to the existing wastewater pumping stations and their capacity shortages also play a significant role in the sewer system malfunction and occurrence of SSOs. The pumping stations are operated within the jurisdiction of Baltimore City and are under the City's consent decree compliance requirements.
- Two wastewater treatment plants (Back River WWTP and Patapsco WWTP) receive wastewater from both jurisdictions. If the City or the County exceeds their allocated flows, the WWTPs may become

overloaded and violate their NPDES permit requirements. By upgrading the Back River WWTP headworks, a major step has been taken to alleviate the impacts of the SSOs in the sewer collection, pumping and treatment capacities.

- Baltimore City's hydraulic modeling of the sewer system and Baltimore County's GIS is mutually benefited from proper sewer capacity planning by both jurisdictions.
- The County has an independent consent decree addressing wet weather sanitary sewer overflows with its own penalties and remedial projects.

Baltimore County

Baltimore County has an allocation of 68.2% of the capacity at the Patapsco WWTP. The County's allocation includes Anne Arundel County and Howard County flows that are conveyed through the County to Patapsco. There is no established allocation for the County at the Back River WWTP. The only other flow limit is for the County Dead Run and Gwynns Falls sewersheds. A maximum combined flow of 97.7 MGD is allowed from the two sewersheds, with Dead Run not to exceed 15.7 MGD and Gwynns Falls not to exceed 87.5 MGD.

There are no penalties if the County exceeds its flow allocation at Patapsco. There is no penalty for exceeding the 97.7 MGD from Dead Run and Gwynns Falls, but the County is expected to make an effort to reduce I/I (inflow/infiltration) if those flows are exceeded at any point. The City reviews proposed County projects to identify if allowable flows will be exceeded and may ask the County to put projects on pause.

When the Wastewater Analyzer Office was jointly staffed, it was expected to produce flow forecasts; however, the following is in place under the current organization structure:

- Baltimore City monitors flows in the collection system with metering sensors and flumes.
- For unmetered areas, water consumption data is used to estimate unmetered flows.
- There are coordination meetings between the City and County to identify future flows.
- There is an annual City-County meeting, which results in an annual wastewater report. The City's Office of Asset Management finalizes the report, which is provided to the County for review.
- The County is not currently providing short-term forecasts; beginning in the 2021-2023 time frame, it will provide long-term flow projections.
- The County is doing build-out projection models.

Coordination between the City and County

- The City and County follow the guidelines outlined in the 1974 Agreement. Both jurisdictions coordinate their sewer capacity planning and perform a well-established effort to keep their flow contribution to the system within the allocated ratios, plan for compliance with the consent decree and prioritize sewer system projects.
- An updated sewer system agreement might be necessary to include sewer monitoring and flow monitoring.
- The County coordinates with the City each time there are projects within the County and near the City/County boundary line that would potentially alter the amount and peak sewage flow released to the City. The City, in addition to monitoring all flows from the County, will evaluate and assess the impact of these projects on the downstream utilities and properties before agreeing to the construction of these projects.

Capital Cost Allocation

The capital cost allocation process is described in detail in *Task 4.1 Capital Programs*. The 1974 agreement defined in detail capital cost allocation methodologies. When the Wastewater Analyzer Office was

formed, the intention was that this jointly staffed office would carry out capital cost allocations. Since the members of the WWAO are no longer co-located, this process is carried out sequentially: the City performs an initial computation, emails it to the County, which performs any needed corrections and emails it back to the City for concurrence.

Flow Allocation

The treatment capacity of the two existing wastewater treatment plants (Back River and Patapsco) is proportionally shared between the sewer systems of the City and County. If the wastewater flow to the WWTP exceeds its treatment capacity, it will result in sewer system backups and/or overloading of the treatment plant that will result in violation of the NPDES permit. The ability to perform inter-sewershed transfers is a planned future capability.

SSO Performance

Although not within the scope of our analysis, we felt it would be worthwhile to provide historical SSO performance as a supplement to the various analyses performed (included as Appendix F).

Benchmarking

Background

The 1972 Clean Water Act Amendments were the driving force behind many of the multi-jurisdictional arrangements related to regional wastewater treatment and conveyance arrangements. As part of CWA, regional plans (called 201 plans after the section in the Act) identified publicly owned treatment works and the areas they would serve. The identified POTWs then received construction grants (in many places with state matching funds) for upgrade and/or expansion. The flow of grant dollars to the identified POTWs was the driving force for the variety of agreements that institutionalized multijurisdictional arrangements for sewer capacity planning.

To identify and analyze the range of intermunicipal agreements, we identified the following to study:

- Upper Occoquan Service Authority (UOSA), VA
- Los Angeles Bureau of Sanitation
- Massachusetts Water Resource Authority (MWRA)
- King County, WA Wastewater Treatment Division
- Blue Plains (DC Water)
- City of Wilmington/New Castle County, DE

Analysis

Of the six IMAs selected for study, the following appeared to represent the spectrum of possible agreements:

- UOSA could be described as the “joint venture” model. There are four signatories to the agreement. The four signatories are the dischargers. All positions on the Board of Directors are filled by the signatories, who strive to make every vote unanimous.
- The Los Angeles Bureau of Sanitation is best described as the “wholesaler” model. LA is the owner of the POTWs. There are individual agreements with the many jurisdictions that discharge to the LA system. LA has ample treatment capacity and will accept as much wastewater as the dischargers can provide. LA’s bill to dischargers combines capital and O&M costs. There is an annual meeting attended by the agencies and the Sanitation Director and executives, where billings, system planning and other issues are discussed.

The other four case studies fall in between the two ends of the spectrum.

Case Studies

Upper Occoquan Service Authority (UOSA), VA

In 1978, the UOSA Regional Water Reclamation Plant, located on 470 acres in western Fairfax County and serving four jurisdictions (Fairfax County, Prince William County, the City of Manassas and the City of Manassas Park), commenced operations. UOSA replaced 11 small secondary treatment plants in the region. Representatives of each discharger constitute the Board of Directors. UOSA agrees to operate and maintain the plant and delivery system efficiently and economically consistent with good business and operating practices for comparable facilities and following applicable standards of the Virginia Department of Environmental Quality (DEQ) and the Occoquan Policy. The original agreement identified the allocation of capacity among the four participating jurisdictions. It also identifies the percentages allocated to the four participating jurisdictions for a planned increase in capacity. The contract spells out how costs are to be calculated. Annually, each participating jurisdiction provides projected flows (based on their sewer capacity modeling) to UOSA. If contracted capacity is exceeded by one jurisdiction, it must buy capacity from one or more of the other jurisdictions. If total capacity is exceeded, a moratorium can be invoked. From the agreement:

> *If a participating political subdivision (discharger) is noted that their average flow for any consecutive 30-day period during the past 48 months has reached 95% of allocated capacity, the political subdivision shall temporarily terminate the issuance of permits which allow start of construction on projects in that portion of the UOSA service area until UOSA plant capacity is increased by reallocation arrangements or 2 other arrangements.*

The four signatories view their arrangement as a joint venture and strive to make every vote unanimous.

Los Angeles Bureau of Sanitation

Los Angeles has 30 contract agency customers, which include several cities, sanitation districts, Universal Studios and federal agencies. Twenty of them have agreements with the same terms, except for some provisions unique to specific agencies. The other ten agencies do not have individual universal terms agreements. The universal terms agreements do not have specific capacity allotments for agencies. Instead, the agencies pay capacity charges for new development and increased discharges in the same manner that internal City customers pay capacity charges. System capacity is not an issue in LA. Wastewater discharges have been shrinking for 20 years due to drought and water conservation. Capital costs are allocated on the same basis as O&M costs, i.e., based on monitored wastewater flow and strength. Agencies do not participate in bond issues, so they do not pay debt service. LA does not have out-of-City surcharges, though the costs paid by the agencies are different than the costs paid by internal customers (no debt service, paying for LA's trunk sewers, but not collection sewers, etc.). LA is responsible for monitoring the flow and strength of wastewater discharged by the agencies. The agencies are responsible for monitoring any wastewater they discharge into LA. LA does not require flow forecasts because of the excess treatment capacity. However, LA evaluates the capacities of sewers downstream of large, proposed agency developments in the same manner that they evaluate the capacities of sewers downstream of large, proposed Inside-City developments. Because of the excess treatment capacity, LA is not concerned about excess discharges from contract agencies; in fact, LA would welcome more flows as it would allow them to reduce in-City rates. Contract agencies contribute only 13 to 14% of LA's total wastewater flow, and they do not have members on LA's Public Works Board or an advisory board. However, there is an annual meeting attended by the agencies and the Sanitation Director and executives,

where billings, system planning and other issues are discussed. There has been some litigation (many years ago) regarding LA's charges regarding lack of transparency in costs and cost allocations.

Massachusetts Water Resource Authority (MWRA)

MWRA was created in 1985, taking over control of the water and sewer systems serving the greater Boston area from the Metropolitan District Commission (MDC). Because the level of wastewater treatment inherited by the MWRA was below federal standards, a federal court order mandated the construction of a new treatment plant. Importantly, MWRA was created as an independent agency with the ability to raise revenues from ratepayers, bond sales and grants. MWRA's enabling act sets requirements for MWRA to provide defined services to all the communities (local bodies) named in the act. MWRA issues annual municipal discharger permits, which provide formal documentation of the points of connection and solicit data from the communities on the number of sewer users. It is a relatively light regulatory touch: MWRA understands its requirement to provide service. MWRA's governance structure includes a board of directors as well as a statutorily-created advisory board. In addition, there is a citizen's advisory board and project-specific committees or workgroups.

MWRA's Board of Directors is made up of 11 members.

- Three members elected by an advisory board
- Three members appointed by the Mayor of Boston (Boston represents about 1/3 of water and wastewater flow)
- One member each from the cities of Winthrop and Quincy, where the largest wastewater facilities are located, appointed by local officials
- Three members appointed by the Governor: two representing the river basins (where the water sources are located) and the Secretary of Energy and Environment, who serves as chair

The Board of Directors is the MWRA. They make or delegate all decisions on budgeting, contracting and planning.

There is an advisory board made up of the chief elected official or designee from each of the 61 communities that receive water or wastewater service from the MWRA (plus a small number of other members). The Board has the statutory authority to review and comment on MWRA's current and capital budgets, to elect three members of the Board and to approve any expansion of the water or sewer service area.

MWRA is obligated to provide service to all the communities listed in their enabling act. If they grow or have portions of their jurisdiction which move from septic to sewer, MWRA is obligated to serve the increase in flow. MWRA's planning protocols acknowledge this. The only exceptions are a couple of communities that have only a portion of their jurisdiction with a sewer district, and the district is the named local body. State policy and MWRA policy dictate that significant developments provide a four to one reduction in I/I to free up capacity of the development within the local sewer shed.

MWRA does not bill individual property owners for sewer service. They charge the local communities an amount that is based on the cost allocation described below. In turn, the local communities bill their customers to recover the MWRA charge plus the amount needed to operate and maintain their collection systems.

Cost Allocation: 75% of capital costs are allocated based on the share of the system-wide population, while 25% of capital costs are allocated based on the share of maximum month metered wastewater flow and strength of flow parameters. 100% of operating costs are allocated based on the share of total metered wastewater flow (using a three-year average to dampen variability). All wastewater flow is either metered or estimated based on metered flow. Also, MWRA's community charge system is based on the

share of parameters. Each fiscal year's charges are allocated to customer communities based on their share of the prior calendar year's flow or population parameters.

Excess Flows: MWRA does not have defined wastewater flow allocations. The MWRA service area is experiencing slow growth. MWRA monitors the state environmental review process for major developments. Some communities have state regulatory conditions contained in permitting for major interceptors, and they are individually responsible for adhering to those allocations. MWRA has no intention of exceeding the WWTP capacity and the capacity of the major tunnels that feed it. Their aggressive I/I program is designed to reduce I/I at a pace to allow for growth without exceeding the capacity of key MWRA infrastructure. This has proven to be successful so far. CSO (combined system overflow) programs have also helped reduce peak flows.

All capital expenses are allocated based on the formula described above. They do not have a mechanism to charge a community or group of communities for new infrastructure serving them; all capital expenses are treated as regional expenses.

The success of MWRA is attributable, in part, to its unique approach to the system-wide allocation of costs, which was facilitated by the voice given to the member communities.

King County, WA Wastewater Treatment Division

The King County, WA Wastewater Treatment Division (King County) has individual contracts with each of 34 local sewer agencies served by its POTWs: 17 cities, 16 special purpose districts and the Muckleshoot Indian Tribe. These local agencies own and operate independent collection systems, which include pipelines and pump stations to collect and carry wastewater flows in their service area to King County's regional system for treatment and disposal. The local agencies have 30-year agreements with King County for this service. King County owns and operates the regional treatment plants, pipelines, pump stations and other related facilities. The sample agreement provided to the project team did not indicate any reservation of capacity.

King County does not bill individual property owners for sewer service. Instead, it charges the local agencies an amount that is based on the County's monthly rate and the number of customers the agency serves. In turn, the local agencies bill their customers to recover the County charge plus the amount needed to operate and maintain their collection systems.

Capital Cost Allocation: Property owners making a new connection to the sewer system pay a capacity charge that is intended to cover 95% of the capital costs needed to serve those new customers. The remaining capital costs are allocated to the sewer rate. Local sewer agencies are billed quarterly by King County based on the number of single-family units on a rolling average plus the number of residential customer equivalents (multifamily and commercial) multiplied by the monthly wholesale sewer rate.

Contract agencies indirectly provide flow forecasts. Every quarter, contract agencies report the number of residential customers and residential customer equivalents estimated to be billed by the agency in the next succeeding month. This becomes the basis for the monthly charge levied to the agency.

The Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC) advises the King County Executive, the King County Council, the Regional Water Quality Committee and the County Council's standing committees on all matters relating to abatement of water pollution throughout King County's wastewater service area. Under State law, each local sewer agency that provides wastewater services within the County's regional service area may serve on MWPAAC. Each local agency may appoint a member plus alternate(s). MWRA governance was one of the models looked at by King County when it formed MWPAAC.

Two committees advise King County. MWPAAC advises the King County Council and Executive on matters related to reducing water pollution. It was created by State law (Revised Code of Washington 35.58.210) and consists of representatives from cities and local sewer utilities that operate sewer systems in King County. Most of these cities and sewer utilities deliver their sewage to King County for treatment and disposal. King County funds the administration of MWPAAC. MWPAAC provides input to King County informally through comments at its general meeting and subcommittee meetings. MWPAAC takes formal positions through recommendation letters that are drafted by MWPAAC membership, voted on and sent to the King County Wastewater Treatment Division Director, King County Executive and/or King County Council as applicable. The King County Council's Regional Water Quality Committee develops, reviews and recommends Countywide policies and plans for water quality and sewer service issues, long-range capital facilities plans, rate policies and facilities siting to guide regional water quality responsibilities considered by the Council.

Blue Plains (DC Water)

Note: the following is based on the 2005 IMA; there have since been addendums.

The 2005 IMA allocates capacity at Blue Plains to the following four user groups:

- District Total: 158.0 MGD
- Other Potomac Interceptor Users: 11.4 MGD
- WSSC: 169.6 MGD
- Fairfax County: 31.0 MGD
- Total: 370.0 MGD

The IMA notes that the District is the NPDES permit holder for the Blue Plains WWTP and holds title to the physical plant and premises, all real property, appurtenances, fixtures and other property at the Blue Plains WWTP. It also notes that, while the District will afford the other parties due opportunity to review and comment on important technical and financial issues, it will continue to exercise its discretion and judgment with regard to operation, maintenance and management of the facility.

The IMA's statement of principles identifies capacity allocation, capital cost allocation and operating cost allocations:

1. The 370 MGD annual average wastewater treatment capacity at Blue Plains shall be allocated among the users in the proportion that each user's financial participation bears to the current value of the completed 370 MGD plant, excluding real property and previous federal grants.
2. The District shall always possess wastewater treatment capacity at Blue Plains sufficient to meet its needs and, under certain conditions, has the right to require Blue Plains users to offload wastewater flows from Blue Plains to other wastewater treatment plants subject to adequate notification and compensation as provided in the agreement.
3. Capital costs shall be allocated among the users in proportion to the wastewater treatment capacity allocation, taking into consideration the historical investment of each user.
4. All operating, maintenance and overhead costs associated with wastewater treatment at Blue Plains shall be shared among the users in proportion to their actual flows to Blue Plains.

The provision of *flow forecasts* is provided through monthly reports:

No later than 15 days after the end of each month, each user shall prepare and send to the District a report on the status of its wastewater flows and commitments. The District shall compile these reports into a single report and distribute this report to the parties no later than 30 days after the end of the month. The District shall also prepare an annual summary report for each calendar year and distribute this report to the parties no later than February 15th of the following year.

In the event of *flows in excess* of reserved capacity:

If the sum of any user's actual flow plus committed flow for any reason exceeds that user's treatment capacity allocation, that user shall immediately stop making any further commitments for hookups, connections and extensions to its sewerage system tributary to Blue Plains until three consecutive months have passed during which the sum of the user's actual flow plus committed flow shall not have exceeded its treatment capacity allocation. The sole exceptions to this prohibition shall be:

1. To eliminate an alternative method of wastewater disposal that has been certified by a duly constituted health officer in the affected user's service area or his designated local representative to constitute a public health hazard. This certification shall be on a parcel-by-parcel basis.
2. For public service buildings, which include schools, hospitals, nursing homes, medical and dental clinics, churches and synagogues and structures used by public agencies in providing essential services for public health and welfare.

Blue Plains Regional Committee:

A. The physical and financial interdependence of the Blue Plains facilities requires a regular forum where technical and financial issues affecting more than one party can be presented and discussed.
B. The existing committees, comprised of representatives of the parties and formed to address Blue Plains facilities issues, are hereby dissolved and replaced by a Blue Plains Regional Committee (BRPC). The BPRC will be the sole coordinating body among the parties for Blue Plains issues and will include one representative of each of the following:
    - District of Columbia
    - Washington Suburban Sanitary Commission
    - Montgomery County
    - Prince George's County
    - Fairfax County
C. Each chief administrative officer will appoint one member and one alternate to the BPRC.
D. The BPRC shall meet monthly for as long as it is deemed appropriate and shall meet at least quarterly thereafter.
E. The agenda of each meeting shall include, but not be limited to, the following topics:
    - Interpretation of this Agreement
    - Plant performance and compliance with permits, administrative orders and consent decrees
    - Wastewater flows, flow metering and flow projections
    - Sludge quantity, quality and disposal operations
    - Sewerage system construction status
    - Status of sewerage system operations and any proposed operational changes
    - Status of the wasted water and infiltration control programs
F. Those issues that are of sufficient importance to, or have a sufficient financial impact on, the parties shall be submitted to the BPRC for review and comment prior to implementation. Such issues may include, but shall not be limited to, the following:
    - Operational changes affecting sludge quantity or quality
    - Substantial changes in the quantity or type of chemicals used
    - Proposed construction projects serving more than one user
    - Those portions of capital and operating budgets to which more than one user will contribute
    - Changes in a financial accounting system would substantially alter the information available for audit
    - Proposed consent decrees, administrative orders or lawsuits that could affect operations or costs

- Water quality issues that affect Blue Plains facilities

G. The details of any substantial public controversy that could affect the operation of the system shall be promptly communicated to the other parties by the party affected.

Note: Due to COVID-19, we were not able to interview members of the BPRC. However, members of the consulting team have performed work for DC Water and are not aware of disputes that rose to the level of threatened or actual litigation.

City of Wilmington/New Castle County, DE

The City of Wilmington wastewater treatment plant serves more than 400,000 residents, with a maximum treatment design flow of 168 MGD and up to 320 MGD in wet weather. It is also notable for being one of the largest wastewater public-private partnerships in the United States. New Castle County is the only discharger to the City of Wilmington's POTW, although other jurisdictions discharge through the County to the POTW. The County has IMAs directly with those jurisdictions. There is also an expired IMA between the County and City that is currently in dispute and is moving to arbitration.

Allocation of Capacity: the IMA between the City and County is the vehicle for allocation of capacity.

The IMA gives the County an average daily flow, but currently, there are no specific restrictions on peak flow (subject to change).

Capital costs are allocated proportionally based upon the flow reserved for the WWTP.

O&M costs are allocated based upon flow. Currently, flows are estimated based upon billed water usage, but the County has a robust system of flow meters, including magnetic flow meters at pump stations that pump directly into the POTW, which are currently not used in the allocation. The County desires to move to a strength and flow-based approach.

Flow capacity is purchased and tracked by County capacity management staff. Allocated capacity is memorialized in either a recorded sewer agreement or industrial wastewater pretreatment permit. The IMA does not require the County to report flow forecasts to the City.

The IMA does not address exceedance of reserved capacity, as there is plenty of capacity at the POTW. The County's industrial pretreatment program includes monitoring requirements. If flow monitoring indicates flows in excess of the permit, enforcement action is taken.

There is a Utilities Citizens Advisory Board, which discusses water and wastewater issues on which the County holds two seats (the City provides water service to some County residents). Board members are voluntary/appointed. The City holds most seats on the board.

There has been a long history of friction between the City and County. Over time, the population of the County has grown so that most of the flows into the plant come from the County. The County strongly resisted the effort by the City to completely privatize the POTW in the mid-1990s. Currently, the IMA has expired, and the issue is moving into arbitration.

Task 5
ASSESS METER TO CASH OPERATIONS

Task 5 consists of five subtasks related to water and sewer meter to cash operations:

1. Metering and Billing Operations
2. County Water Service Revenue Collection and Annual Reconciliation Process
3. City-County Data Transfer
4. Customer Service Performance
5. County's Sewer Billing and Meter Applications Permitting

Each of these subtasks is examined in the remainder of this report.

Task 5.1 Metering and Billing Operations

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review the business processes associated with the existing meter reading, meter services, billing, billing adjustments, settlements and collections functions
- Define and summarize core functions and critical processes, including identifying and resolving data exceptions
- Summarize the strengths, constraints and opportunities for enhancing efficiency in the existing processes and policies
- Benchmark the alignment of the City's meter to cash processes with industry best practices

Methodology

The project team reviewed the metering and billing processes via a review of historical records, data and information collected via discussions with City and County staff to identify potential inefficiencies, errors and departures from best practices.

The project team compiled a list of stakeholders to identify critical participants for both the County and City for data requests and discovery sessions. Using this list, the team collaborated to determine the appropriate participants for each task/subtask-based discussion. Ultimately, the project team arrived at an ample inventory of personnel representing County and City departments that would need to participate in each task's process topic actively. The stakeholder list was analyzed to understand the personnel, their agency and their participation in each process of the tasks and subtasks. This list served as the foundation of the outreach plan. The list was reviewed, validated and updated as necessary to identify changes within the staff and roles and responsibilities.

Data and information requests specific to metering and billing were submitted to both Baltimore City and Baltimore County stakeholders as the first step in the analysis. A centralized FTP repository was created for ease of uploading the data and documentation requested.

The response to our preliminary information request was significantly delayed, and we received only a subset of the information requested. Of the 11 items included in the original RFI associated with this sub-task, we received no response or partial response to six of the requested items.

Due to the limited amount of written documentation and data available for this analysis, the project team was reliant on interviews with key staff to provide details on processes, procedures and practices. Due to the City staff's limited availability due to the pandemic, we did not have the opportunity to conduct interviews related to the Meter Shop. This effort was further hampered by the unexpected departure of the City's Utility Billing Manager in early October 2020.

Background

Baltimore's Water System has approximately 192,500 City customer accounts and 208,000 County customer accounts. The City is responsible for all aspects of the "Meter to Cash" process for all water customers in both jurisdictions, including reading and maintaining water meters, customer billing, customer service and collections functions.

The City replaced most of its manual read residential water meters with advanced metering infrastructure technology between 2014 and 2016. The City's AMI system collects reads from City customers monthly

using an automated network of radio transmitters and receivers. This project (known as the BaltiMeter initiative) coincided with the implementation of a new customer billing system (UMAX) and a change from quarterly billing to monthly billing.

After completing the conversion of City customers to AMI, a similar effort was undertaken for County customers. Most of the residential meters in Baltimore County have been converted to automatic meter reading technology, but meter readings are collected with mobile units driven by City meter reading staff on a quarterly cycle. Baltimore County customers are billed by Baltimore City quarterly.

In 2016, the City replaced a legacy customer information system with a modern utility customer information system called UMAX (developed by Itineris) to manage its customer accounts and billing. The deployment of UMAX enabled the City to implement monthly billing for its customers.

For a variety of reasons, the City did not move County customers to a monthly billing cycle and continued to process water bills with its legacy billing system. A review of historical correspondence from this period indicates that the County revealed a number of concerns that were raised by the County regarding the transition to AMI, the new billing system and a monthly billing cycle, including:

- Excessive numbers of adjustments to County water accounts
- High level of zero reads
- The impact of systemic meter changes on customer billing
- Unexplained changes in overall water consumption
- Issues raised in the City Comptroller's audit of water billing practices

As a result, County billing remains in the legacy system, and plans to transition County customers to UMAX will require further discussions and coordination between the City and County.

In 2018, the County offered to assist the City by providing meter reads for County accounts, taking over meter maintenance for County accounts and assisting with remaining meter installations in the County. The City agreed to allow the County to assist with remaining meter installations but did not agree to assist with performing meter reads or meter maintenance.

In March 2020, as a result of the COVID-19 pandemic, all City DPW Meter Shop employees were placed on leave. Eighteen employees have returned to the Meter Shop, but only 11 had the training and background to handle meter-related tasks. Additionally, all the Meter Shop vehicles equipped for meter reads, installation and maintenance (except one) were loaned to other agencies during this time.

In October 2020, the City announced a plan to outsource meter reading, small meter installations and meter maintenance for both the City and County to an outside contractor; however, that plan had not moved forward as of January 2021.

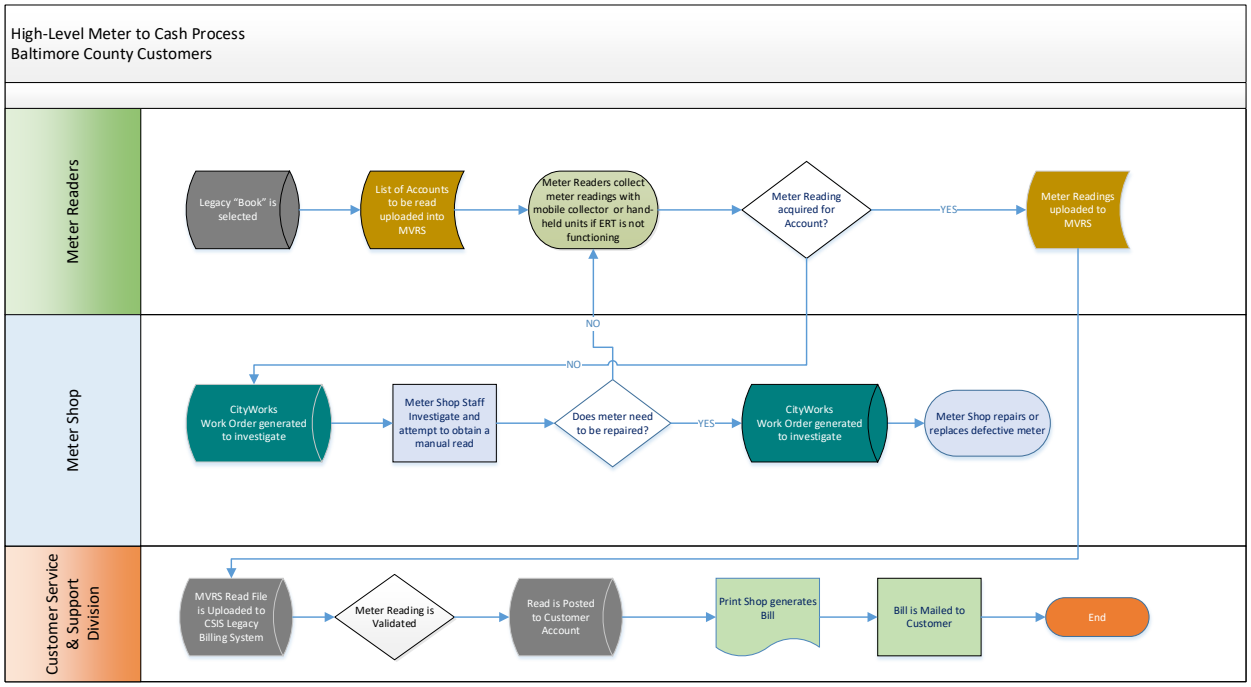
Current Meter-To-Cash Process

Meter reading and customer billing are the responsibility of the Customer Service & Support Division in the Department of Public Works. This unit consists of 225 full-time employees, including 86 meter reading and meter maintenance technicians assigned to the Meter Shop and 110 customer care analysts who make up the Utility Billing unit.

The City's approach to customer billing and metering is similar to the approach used by most large water utilities. It has modernized its water meter infrastructure to state-of-the-art technology that is less error-prone than the outdated manually read meters. It has updated its customer billing system to newer technology that is more flexible and provides enhanced reporting and analytical capabilities. Also, it has moved to monthly billing. All of these initiatives are recognized as best practices within the industry.

Unfortunately, much of this modernization has not been applied to the County portion of the service area. The City is simultaneously running two separate and distinct billing methods: a quarterly billing process on a legacy computer system and a monthly billing process on a newer platform.

Exhibit 5-1. Meter-to-Cash Process for County Customers



The current Cash-To-Meter process for County customers has several features that make the City's billing and metering approach particularly vulnerable to disruptions that prevent customers from regularly receiving accurate water bills.

To read all 208,000 County water meters on a regular quarterly schedule, meter readers in the County have to complete all assigned routes every 90 days, at approximately the same time within each quarter. Disruptions to the meter reading schedules due to weather, approved and un-approved absences or equipment malfunctions can potentially impact the entire billing cycle.

Second, the process requires staff to be well-trained to use the meter reading technology deployed and have a clear understanding of the Division's applicable SOPs. County meter readers typically work in the field unsupervised, so the supervisor must have a high degree of confidence that meter readers perform this function efficiently, effectively and consistently. For instance, CSSD's SOP for County meter reading requires staff to stop, leave the vehicle and attempt to get an accurate read with a hand-held device if the mobile collector did not register the reading. If this procedure is not performed all the time, an excessive number of accounts will not be read within the quarter.

Third, although much of the Meter-To-Cash process's data processing aspects are automated, some functions require manual human intervention to ensure that meter readings are moved between systems. For instance, the transfer of data into and out of MVRS requires oversight by Meter Shop staff on a daily basis and the transfer of meter reads into the legacy billing system requires manual processing by the City's IT staff.

Fourth, a common issue when meters do not work properly is for the transmitters to break, become disconnected from the meter or stop transmitting. When this occurs, timely repair of these units is necessary to ensure that no billing interruption occurs.

Fifth, like any other type of buried asset, water meters require constant maintenance to ensure that they operate correctly. A water meter that stops accurately registering will generate billing errors that may be difficult for the consumer to detect. For the process to work effectively on a sustainable basis, meter maintenance functions must be tightly integrated with the meter readers' activities.

Finally, an effective Meter-To-Cash process must have a systematic quality assurance/quality control procedure to ensure that meter reading anomalies and billing errors are caught and corrected before bills are issued.

Key Findings & Observations

The project team identified seven significant findings during our review of the City's metering and billing procedures. In general, these findings confirm many of the issues and problems identified in the Baltimore City Inspector General's report released in December 2020.

Operating Two Different Meter-To-Cash Processes at the Same Time

The City initiated a costly and comprehensive modernization of the system's metering and billing systems in 2014. Although this modernization effort was intended to encompass both City and County customers, for reasons discussed earlier, there have been several issues. County customers are not being billed on the same frequency as City customers, County bills are being generated with a different system, and County meter readings are being performed using different technology.

This current state presents numerous problems for the utility, not the least of which is the cost and inefficiency of maintaining two different systems simultaneously. Staff has to be trained to operate both systems. There are separate policies and procedures for City and County customers. Additional system maintenance costs have resulted from the need to operate the CSIS legacy billing system alongside the new UMAX system. As discussed in the next section, running two different billing systems has also complicated the annual reconciliation process and introduced financial errors into the annual settlements.

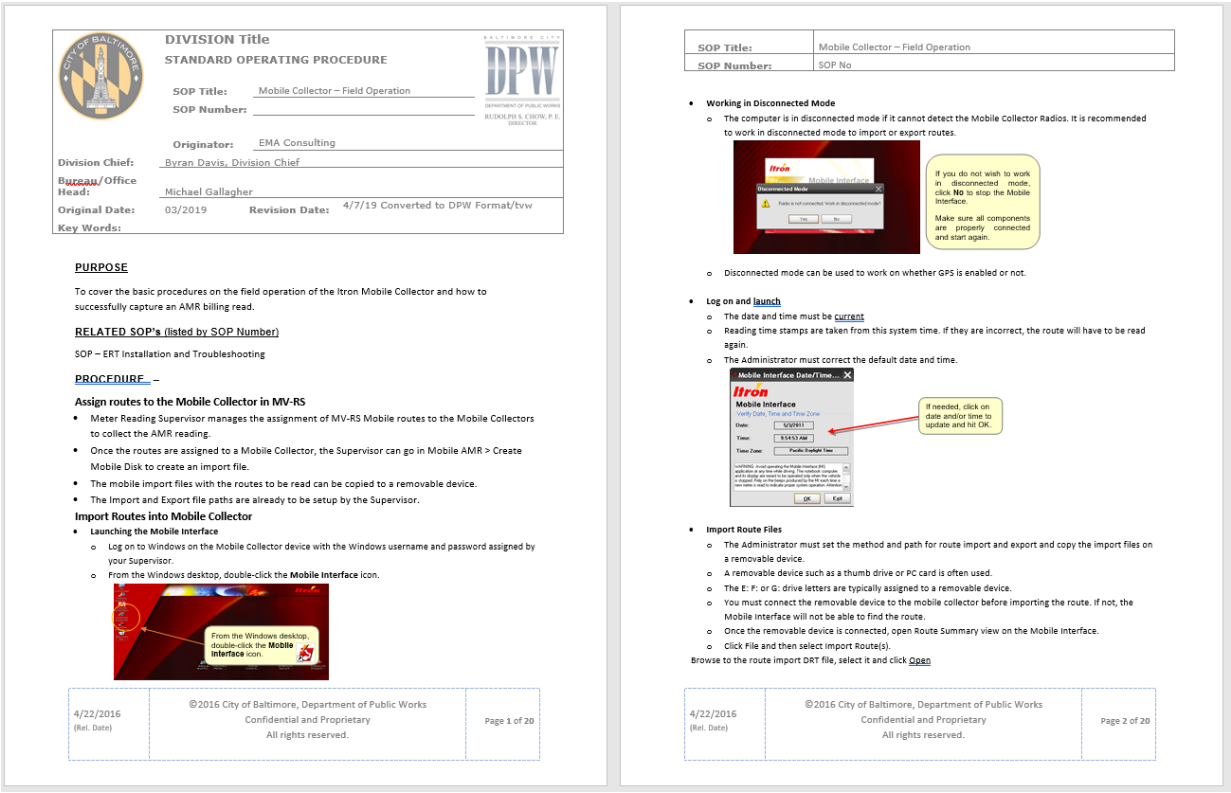
Clear, Documented SOPs for Most Cash-to-Meter Functions but Unclear if SOPs are Consistently Implemented

The City CSSD staff provided 73 discrete standard operating procedures that document all aspects of the Cash-To-Meter process, including 14 SOPs specific to the Meter Shop's operation.

- Meter Reading Exception
- ERT Installation & Troubleshooting
- Handheld Operation Meter Reading
- Intermediate and Large Meter Installations
- Large Meter Field Testing
- Meter Inspections
- Mobile Collector Field – Operations
- Mobile Collector Field – Administrative
- MVRS Meter Shop
- Small Meter Bench Testing
- Abate In House Meter Tech Work Orders
- In-House Meter Tech Field Investigation
- In-House Meter Tech Field Turn On/Off
- In-House Meter Tech Water Turn On/Off per Request

As shown in the example below, CSSD's standard operating procedures provide detailed step-by-step instructions and include graphics, pictures and flowcharts to facilitate understanding. They are clearly written and easy to follow.

Exhibit 5-2. Example SOP: Mobile Collector – Field Operation



DIVISION Title
STANDARD OPERATING PROCEDURE

SOP Title: Mobile Collector – Field Operation
SOP Number:
Originator: EMA Consulting
Division Chief: Byran Davis, Division Chief
Bureau/Office Head: Michael Gallagher
Original Date: 03/2019 Revision Date: 4/7/19 Converted to DPW Format/tvw
Key Words:

PURPOSE

To cover the basic procedures on the field operation of the Itron Mobile Collector and how to successfully capture an AMR billing read.

RELATED SOP's (listed by SOP Number)

SOP – ERT Installation and Troubleshooting

PROCEDURE –

Assign routes to the Mobile Collector in MV-RS

- Meter Reading Supervisor manages the assignment of MV-RS Mobile routes to the Mobile Collectors to collect the AMR reading.
- Once the routes are assigned to a Mobile Collector, the Supervisor can go in Mobile AMR > Create Mobile Disk to create an import file.
- The mobile import files with the routes to be read can be copied to a removable device.
- The Import and Export file paths are already to be setup by the Supervisor.

Import Routes into Mobile Collector

- Launching the Mobile Interface
  - Log on to Windows on the Mobile Collector device with the Windows username and password assigned by your Supervisor.
  - From the Windows desktop, double-click the **Mobile Interface** icon.

From the Windows desktop, double-click the **Mobile Interface** icon.

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SOP Title: Mobile Collector – Field Operation
SOP Number: SOP No

- Working in Disconnected Mode
  - The computer is in disconnected mode if it cannot detect the Mobile Collector Radios. It is recommended to work in disconnected mode to import or export routes.

If you do not wish to work in disconnected mode, click **No** to stop the Mobile Interface.

Make sure all components are properly connected and start again.

  - Disconnected mode can be used to work on whether GPS is enabled or not.
- Log on and launch
  - The date and time must be current
  - Reading time stamps are taken from this system time. If they are incorrect, the route will have to be read again.
  - The Administrator must correct the default date and time.

If needed, click on date and/or time to update and hit OK.

- Import Route Files
  - The Administrator must set the method and path for route import and export and copy the import files on a removable device.
  - A removable device such as a thumb drive or PC card is often used.
  - The E: F: or G: drive letters are typically assigned to a removable device.
  - You must connect the removable device to the mobile collector before importing the route. If not, the Mobile Interface will not be able to find the route.
  - Once the removable device is connected, open Route Summary view on the Mobile Interface.
  - Click File and then select import Route(s).

Browse to the route import DRT file, select it and click Open

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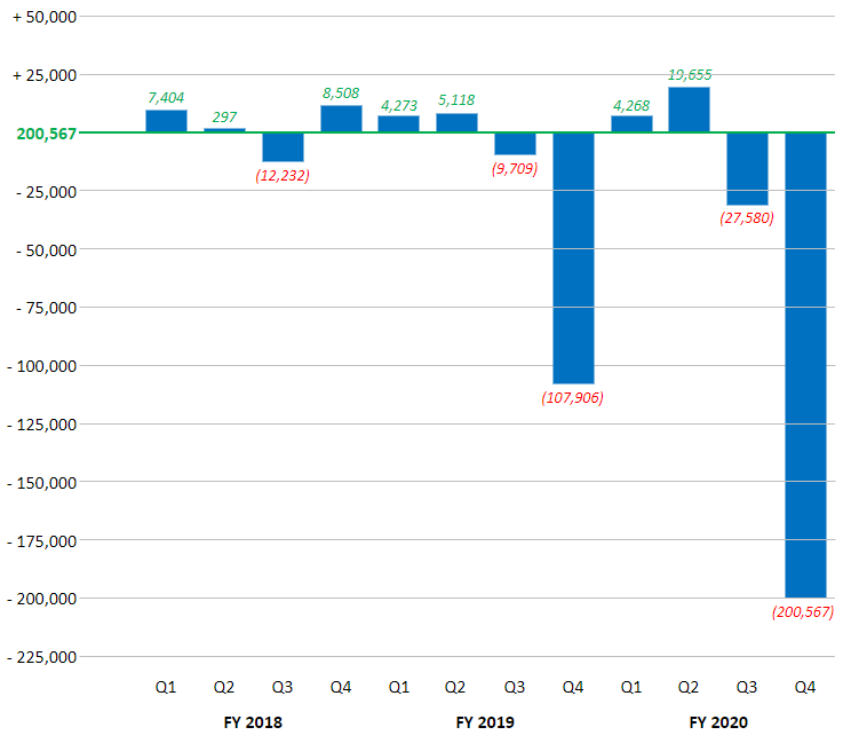
Most of the SOPs reviewed were created after 2018, with most created in 2019. All have noted the name of the Division Chief and the Bureau/Office Head. However, CSSD provided no documentation that the SOPs had been disseminated to all staff, that staff had received training on the SOPs or that supervisors or managers have documented compliance with the procedures.

Ransomware and COVID-19 Impacts on Meter Reads

Our analysis of approximately three years of County meter reading activity clearly shows how the ransomware attack impacted the City's meter reading operations in May 2019 and the COVID-19 pandemic in March 2020. Both events resulted in a halt to County meter reading, which can be seen in the dramatic drops in quarterly reads in the fourth quarter of 2019 and the fourth quarter of 2020.

The COVID-19 pandemic impacts are more far-reaching, resulting in most Meter Shop employees being placed on leave from March 2020 to October 2020. The City successfully restarted County meter reading in the Fall of 2020 with assistance from a third-party contractor, and bills were issued to most County customers prior to the end of December 2020. It is anticipated that Meter Shop employees will resume meter reading activities in the County beginning in early 2021.

Exhibit 5-3. Differential of Average Meter Read by Quarter for Quarter



City's Meter Shop has Large Backlogs of Pending Work and Does Not Resolve Repairs to Water Meters on Time

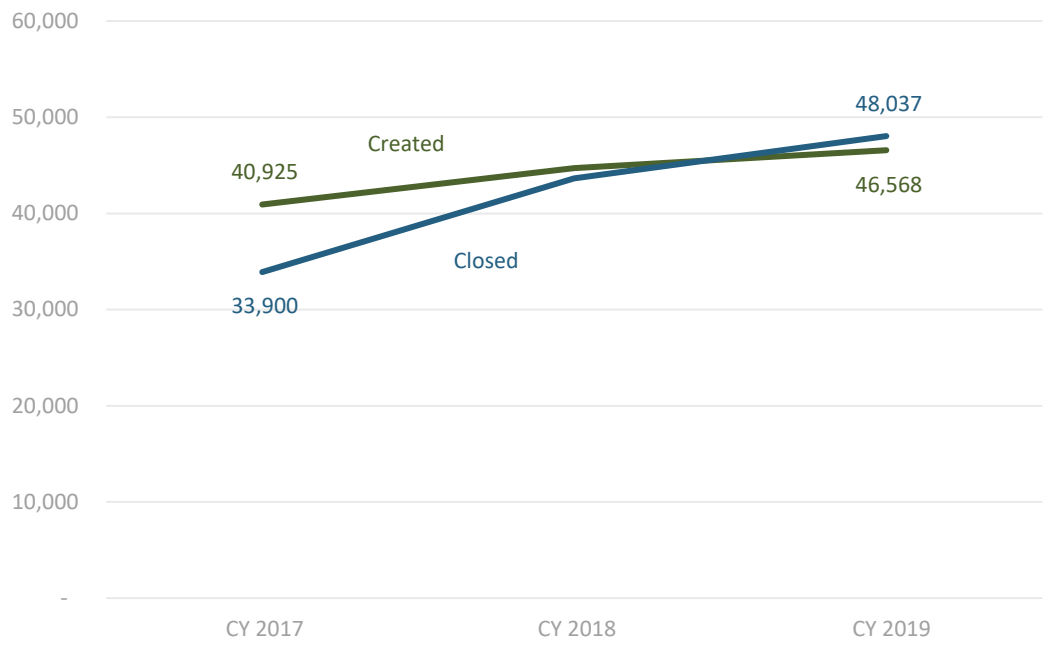
The project team analyzed approximately three years of recent work order data from the City's Cityworks system to assess the performance of the City's Meter Shop. The data that we were provided did not allow us to distinguish between the levels of service being provided to City customers relative to County customers, and we were unable to interview managers in the City's Meter Shop to develop an understanding of work order prioritization, quality assurance, communications with the County or how standard operating procedures are being implemented.

Significant findings in three performance areas are documented below:

Work Order Volume

An examination of total work orders created and resolved over the past three years indicates the Meter Shop is currently resolving work at a greater rate than work orders are being created, suggesting that existing backlogs of work are being reduced.

Exhibit 5-4. Meter Shop Work Activity



Work Order Resolution Time

Our analysis revealed a dozen work order categories that took, on average, more than 50 days to resolve. Recent performance, shown in CY 2019 data, indicates the Meter Shop was able to significantly reduce the resolution time for many work categories, notably with the Large Service Pressure Checks category, reducing the average resolution time from 330 days in 2017 to 77 days in 2019.

Exhibit 5-5. Work Order Resolution Time (in days)

Work Order Type	CY 2017	CY 2018	CY 2019	Average
CSSD-Water Large Service Pressure Check	330.01	295.72	77.67	290.32
CSSD-Water Account Referral	263.93	107.75		231.05
CSSD-Gas Pump Excess Vault Water	1015.50	447.00	124.03	189.55
CSSD-Large Meter Repair/Replace	237.82	169.19	131.33	183.75
CSSD-Clean Out Meter Vault		466.83	123.23	158.78
CSSD-New Water Meter Installation	194.51	110.70	59.25	132.03
CSSD-Large Water Meter Repair	161.08	92.40	60.48	119.70
CSSD-Contractor ERT Repair/Replace		58.91	138.88	98.08
CSSD-Locate Meter	70.16	71.05	145.36	80.03
CSSD-Water Meter Replace Cover	92.42	55.66	41.58	57.05
CSSD-Large Meter ERT Repair/Replace	755.50	664.00	49.87	52.95
CSSD-Water Meter Replacement	60.24	51.19	41.65	50.36

Work Order Backlog

A snapshot of open CSSD-related work orders was generated on June 25, 2020. As of this date, the Meter Shop had 3,643 open work orders, many of which were more than 365 days old. A significant part of this backlog was made up of large meter maintenance work; however, the City's use of contractors to perform large meter work contributes to the age of these work orders.

A recent investigation by the City's Office of the Inspector General found that more than 14,000 new City meters and more than 8,000 new County meters installed under the City's BaltiMeter program had some sort of operational issue that prevented an accurate read from being collected.

The IG report stated that the primary reason the 22,000 meters were not functioning was due to issues with the Encoder Receiver Transmitter (ERT) components.

According to the City's SOPs, any operational problem found with any meter in the City or County, including meters that are producing zero reads, should have an associated Cityworks work order record. Our review of the Cityworks database indicated that there were only 426 open ERT-related work orders in the system, so we could not directly verify the IG's findings. Although CSSD has a detailed SOP for documenting the work performed by in-house meter technicians as part of the work order record in Cityworks, an in-depth review of the City's work order abatement procedures was beyond the scope of our assessment of Meter Shop operations.

Exhibit 5-6. Current Backlog of Cityworks Work Orders as of June 25, 2020

Work Order Type	Open	Age (days)
CSSD-Large Meter Repair/Replace	883	578
CSSD-New Water Meter Installation	676	557
CSSD-Large Water Meter Repair	557	672
CSSD-Water Meter Investigation	426	485
CSSD-Large Meter ERT Repair/Replace	331	203
CSSD-Water Remove Meter	189	702
CSSD-Water Meter Replacement	183	342
CSSD-Water Meter Replace Cover	148	390
CSSD-ERT Repair/Replace	95	256
CSSD-Locate Meter	79	326
CSSD-Water Large Service Pressure Check	39	615
CSSD-Clean Out Meter Vault	28	426
CSSD-Gas Pump Excess Vault Water	5	288
CSSD-Water Turn On (Request)	2	525
CSSD-Residential Leak Detection Test	1	192
CSSD-Water Turn Off (Request)	1	239
Total	**3,643**	

No Effective QA/QC Process to Find and Correct Billing Errors

Although the CSSD unit has numerous, detailed SOPs that provide clear guidance on how all aspects of the Meter-to-Cash process should be implemented, our review of the data and interviews with key managers revealed breakdowns in some basic quality assurance/quality control (QA/QC) processes and supervisory oversight of the metering and billing process. Issues that we discovered during our review included:

- Problems with how accounts with multiple meters were configured in UMAX
- Issues with bypass valves on certain types of force main meters that result in underbilling of customer water usage
- Incorrect meter designations on accounts leading to billing errors
- Metering issues being discovered after the fact by County staff instead of being found by CSSD
- Incorrect ERT designation being assigned to customer accounts

These findings generally confirm and support many of the conclusions reached by Baker Tilly in its 2018 evaluation and by the City's Inspector General in its report released in 2020.

Inconsistent Adjustments of County Customer Water Bills with No Clear Justification

CSSD's SOPs for implementing billing adjustments require requests to be documented and processed via data entry by CSSD. Since the Legacy system has no imaging capabilities, the paper documentation is filed and stored for retrieval, if necessary. The County's Metropolitan District Financing and Petitions Division (Metro) routinely performs verification and validation on County adjustments as part of its sewer billing process. The County also performs a review when a customer calls to question sewer charges, and they identify that the water bill has been adjusted.

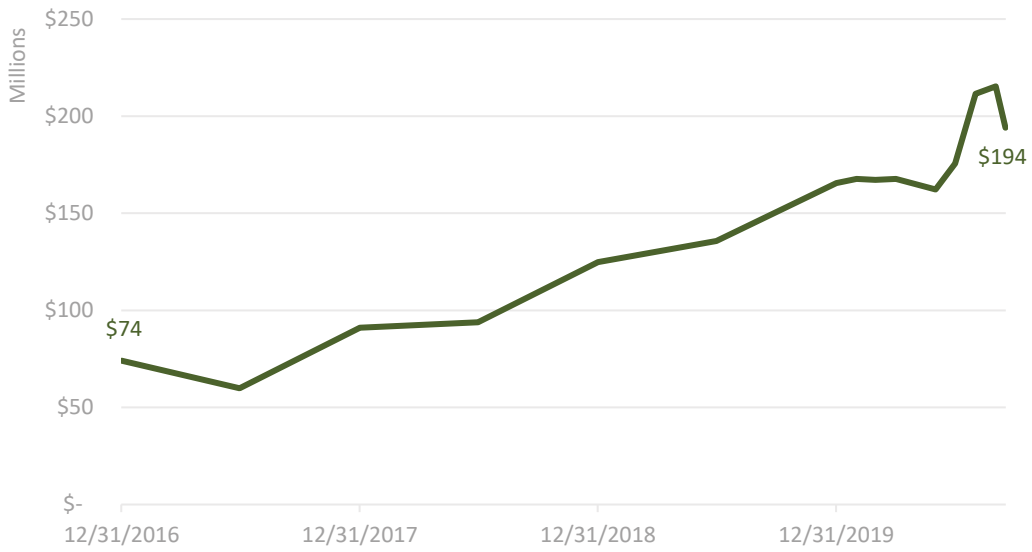
CSSD does not have an automated way to attach documentation to the electronic record for County accounts, so paper documentation must be transmitted to support the verification process. This documentation is, according to County staff, often found to be missing or unavailable.

The County has also pointed to examples where adjustment codes are misused when adjusting County water accounts. In one example, CSSD personnel used a credit allowance to adjust an account, but it was unclear why it was being made. In other examples, bills were adjusted using an administrative code with no documentation of the reason for the change.

The City has a Significant and Growing Problem with Uncollected Revenue

An analysis of an aged receivables report provided by CSSD revealed a startling and unsustainable trend for the utility. At the end of FY 2017, the utility reported an outstanding balance for accounts over 30 days old of $59.86 million. The outstanding balance of receivables 30 days or older, on 9/15/2020, had risen to over $194.04 million.

Exhibit 5-7. Combined Utility Estimated Delinquent Balance ($, millions)



City staff reported in interviews that they believe that much of the current delinquency problem can be attributed to temporary halts in collections and turn-off policies that the City administration enacted after the ransomware attack and continued through the COVID-19 pandemic.

In September of 2020, the City estimated that there were approximately 110,000 delinquent accounts among City customers and 29,000 delinquent accounts among County customers. The resulting delinquency rate for the combined utility, using AWWA's performance benchmarking definition (percentage of delinquent accounts in any 12 month period compared with the number of total accounts), is approximately 35%. This rate of delinquency places Baltimore in the lowest 25th percentile of combined utilities, based on AWWA's most recent benchmarking study. Although the COVID-19 pandemic is a likely cause of much of the system's current delinquency issue, both jurisdictions should focus on customer payment trends and review collections policies to ensure that revenue stabilizes once the impacts of the pandemic begin to ease.

Alignment with Industry Standards and Benchmarks

It is difficult to compare the City and County's approach to metering, billing and collections because the utility operates two separate Meter-To-Cash processes, one for City customers and one for County customers.

The Meter-To-Cash process used for City customers employs AMI technology and a modernized billing system to generate monthly bills. These are all industry-recognized best practices.

The City has a well-developed customer assistance program (BH20) that provides generous subsidies for low-income customers and senior citizens. The City's approach to its customer assistance programs is modeled on recognized best practice affordability programs. Baltimore County maintains programs to assist veterans and seniors with sewer bills.

The Meter-to-Cash process is markedly different for County customers. AMR meters are read with drive-by mobile collectors, and customer bills are generated quarterly with a legacy mainframe-based system in place for several decades.

We have identified the following Meter-To-Cash best practices to use in this assessment:

AMI Fully Implemented

Advanced metering infrastructure enhances a utility's ability to provide consistent and accurate water reads by eliminating meter reading disruptions and providing greater billing flexibility.

Billing System Modernization

State-of-the-art utility billing systems have open data architectures, are customizable, have robust report generation capabilities, support the generation of analytics, can integrate with other systems and can be easily modified to implement new programs or procedures. An over-reliance on outdated technology limits a utility's ability to provide better information to customers and implement system changes.

Monthly Billing Frequency

There are many advantages to monthly billing, not the least of which is identifying leaks and other usage changes more quickly. There should be a process to resolve disputes (including technical disputes) promptly.

Customer Assistance Program

A well-designed customer assistance program aligned with the water affordability challenges within a customer base can reduce collection costs, help customers avoid being turned off and reduce overall delinquency rates.

Performance Measurement

A robust performance management process integrated into a continuous improvement program is a recognized best practice for high-performing utilities.

Collection Performance

Reducing the rate of delinquency with well-designed collections policies is a recognized industry best practice.

These opportunities are presented in the exhibit below.

Exhibit 5-8. Alignment with Key Principles and Opportunities for Improvement

Best Practice	City Alignment	County Alignment
AMI Implementation	Fully implemented	AMR implemented; AMI partially implemented
Modernized Billing System	UMAX upgrade in 2016	Billing on outdated legacy system
Monthly Billing	Implemented	Quarterly billing
Customer Assistance Programs	BH20 program provides a full range of assistance options	Programs to provide assistance to senior citizens and veterans
Performance Measurement	Few indicators currently measured	Few indicators currently measured
Collections Performance	Evidence of increasing rates of delinquency	Evidence of increasing rates of delinquency

Task 5.2 County Water Service Revenue Collection and Annual Reconciliation Process

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review the existing fee estimation and true-up process for the provision of water services to the County
- Define and summarize the process and policies pertinent to the budget/true-up processes, and inter-governmental exchange of information
- Provide objective observations on the strengths, constraints, and opportunities for enhancing efficiency in the existing budget/true-up processes and policies
- Benchmark the alignment with industry best practices

Methodology

The project team reviewed the revenue collection and annual reconciliation processes using a three-phased assessment approach involving a review of historical records and cost allocation data, interviews with key City and County staff and process mapping to identify potential inefficiencies, errors and departures from best practices.

The data collection phase of this subtask was extensive. The project team reviewed over 200 documents related to the annual water reconciliation process, including cost allocation model (CAM) runs for fiscal years 2015 through 2020, inter-jurisdictional correspondence from 2009 to 2020 and internal reviews of annual settlements performed by City contractors and County Water Analyzer Office staff.

To develop a thorough understanding of current processes and critical issues associated with the true-up process, we conducted in-depth interviews with several managers and staff.

Using information gathered in the first two phases of our review, we documented the current revenue collection and annual reconciliation processes, critically evaluated the current state against established industry standards and the methodologies outlined in the 1972 Inter-jurisdictional Water Agreement and identified opportunities for improvement.

A summary of our review and presentation of key observations are provided in the “Findings and Observations” section at the end of this report.

Background

Under current Maryland law, Baltimore City is obligated to provide potable water to Baltimore County residents “at cost.” The 1972 Water Agreement (specifically Articles VII through XII) describes how costs related to the operation of the water system will be reconciled between Baltimore City and Baltimore County on an annual basis:

- **Article VII** of the agreement established Baltimore County’s obligation to pay, on an annual fiscal year basis, its proportionate share of all expenses resulting from the operation, maintenance and administration of the Baltimore Water System.
- **Article VIII** established how costs associated with customer billing, collections and customer service functions are to be allocated to Baltimore County.
- **Article IX** established how debt service costs are to be allocated among the parties.

- **Article X** specifies that each jurisdiction's share of major pipeline (mains 12" or larger) repair and rehabilitation costs will be assigned based on original capital cost allocations.
- **Article XI** identifies responsibility for planning, design and construction of new water facilities with corresponding locality where the facility will be constructed and allocates capital expenditures for filtered water pipelines by the flow distribution method and capital expenditures for filtered water pumping station and storage facilities by the incremental volume method.
- **Article XII** requires the City to submit the Annual Water Cost Reconciliation Statement to the County by December 31st of each year and the transmittal of settlement funds within 60 days of receipt of the statement.

The City's obligation to provide water to Baltimore County "at cost" means that annual operation and maintenance costs must be reconciled or balanced with the annual amount of revenue collected from Baltimore County customers. If the amount of revenue collected is less than the County's proportional share of costs, the County is required to make up the difference with a direct payment to the City. If annual billed revenue exceeds the County's proportional share of costs, the City is required to remit the difference directly to the County.

The annual reconciliation process (or "annual true-up") requires the City and County to cooperatively develop an end-of-year financial statement that identifies operational costs related to the operation and maintenance of the water utility for the prior fiscal year, the amount of revenue collected by Baltimore City directly from Baltimore County customers and Baltimore County's proportionate share of those operational costs.

The 1972 Water Agreement establishes a methodology for determining how operational costs are to be allocated to the County. The methodology is necessarily complex because it defines how the cost of service is calculated for every element of the utility.

The annual reconciliation process uses several key cost allocation principles that are built into a set of financial calculations used to calculate the annual water settlement. These principles are defined in Article I of the agreement:

- **Flow Distribution Method -** Requires a hydraulic analysis, usually done on an analog and/or digital computer, of the water system or portion of the water system based on the design requirements used to select any improvement. Ratios of cost responsibility shall be developed by dividing the rate of water to be supplied to each political subdivision by said improvement under the design requirements used to select the improvement by the total rate of water to be supplied to all of the political subdivision by said improvement under the design requirements used to select the improvement.
- **Incremental Volume Method** - Requires a tabulation of the estimated increase in peak daily filtered water usage projected for each political subdivision from the time the improvement is to be placed in service until the end of the design period. Ratios of cost responsibility shall be developed by dividing the increase in peak daily filtered water usage projected for each political subdivision by the total increase in peak daily filtered water usage for all of the political subdivisions.
- **System Volumetric Method** - Requires a tabulation of the actual quantity of filtered water, including zonal unaccounted water, supplied to each political subdivision in all of the zonal distribution system. Ratios cost responsibility shall be developed by dividing the actual quantity of filtered water, including zonal unaccounted water, supplied to each political subdivision by the total quantity of filtered water supplied to all the political subdivisions.
- **Zonal Volumetric Method** - Requires a tabulation of the quantity of filtered water, including unaccounted water, actually supplied each political subdivision in the journal distribution system or systems served by said pipelines, pumping stations and/or storage facilities. Ratios of cost responsibility shall be developed by dividing the quantity of filtered water, including unaccounted

water, actually supplied to each political subdivision by the total quantity of filtered water, including unaccounted water, actually supply to all the political subdivisions served by said pipelines, pumping stations and/or storage facilities.

The 1972 Water Agreement specifies that all expenses involved with the operation, maintenance and administration of various facilities and functions shall be proportioned by the System Volumetric Method. This includes expenses associated with the collection, transmission and treatment of raw water, the general supervision Division of Water Supply of Baltimore City, Engineering Services in the Division of Water Supply not charged to specific projects, the operation and maintenance of pipelines 12 inches and larger in the Zonal Distribution Systems within Baltimore City and storerooms and yards utilized in the operation and maintenance of Filtered Water Facilities.

The 1972 Agreement further specifies that expenses associated with the operation, maintenance and administration of the chlorinator stations operating in conjunction with filtered water pumping stations, reservoirs and tanks in the Baltimore Water System, filtered water pumping stations and the filtered water reservoirs and tanks are allocated using the Zonal Volumetric Method.

Expenses related to engineering services and field inspection services provided by the City on County projects, the installation and repair of water meters, the investigation of complaints within Baltimore County, services provided by the City Water Consumer Services Division to Baltimore County residents and operation and maintenance of the Zonal Distribution Systems within Baltimore County are fully allocated to Baltimore County under the 1972 Agreement.

At the time that the 1972 Agreement was written, there were certain billing, data processing, customer service and collections functions provided by the units within the City government that were not solely supported by the Baltimore Water System. For these expenses, certain formulas were derived to estimate the County's proportional share of those costs. These expense categories include:

- 40% of the Bureau of Collections expenses were allocated to the water system
- 100% of the direct and indirect expenses incurred by the Metered Water Section of the Bureau of Data Processing are allocated to the water system
- Baltimore County's allocation of these costs is based on the percentage of water bills issued to County customers
- Baltimore County's share of the City's customer service handling expenses is based on the percentage of complaints attributed to County customers

In addition to the allocation of direct expenses for various functions that are performed by the City to provide water to County residents, the 1972 Agreement provided for an additional 6% to be added to cover indirect costs not specifically identified in the Agreement. A breakdown of the specific cost elements identified in the 1972 Water Agreement is provided below.

Exhibit 5-9. 1972 Water Agreement Cost Elements

Cost Component	Cost Basis	Agreement Reference
The collection, transmission and treatment of raw water	System Volumetric	Article VII.A
The general supervision of the administration section of the division of water supply of Baltimore City except those charges excluded under Article IV of the agreement (joint planning)	System Volumetric	Article VII.A
The engineering services in the Division of Water Supply not charged to specific projects	System Volumetric	Article VII.A

Exhibit 5-9. 1972 Water Agreement Cost Elements

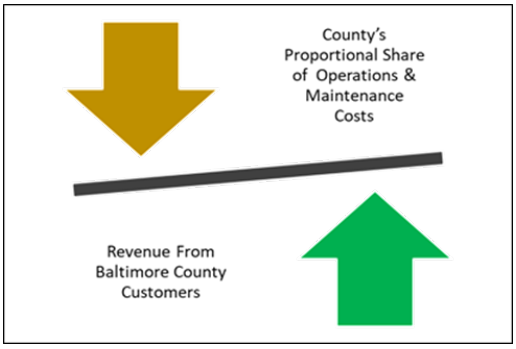
Cost Component	Cost Basis	Agreement Reference
The operation and maintenance of all pipelines in the zonal distribution systems within Baltimore City until June 30, 1972; Effective July 1, 1972, and continuing thereafter, this item shall include only the operation and maintenance of pipelines 12 inches and larger in the zonal distribution systems within Baltimore City	System Volumetric	Article VII.A
The storerooms in yards are utilized in the operation and maintenance of filtered water facilities	System Volumetric	Article VII.A
The chlorinator stations operated in conjunction with filtered water pumping stations, reservoirs and tanks in the Baltimore water system	Zonal Volumetric	Article VII.B
The filtered water pumping stations supplying the Baltimore water system	Zonal Volumetric	Article VII.B
The filtered water reservoirs and tanks supplying the Baltimore water system	Zonal Volumetric	Article VII.B
The engineering in services rendered by the City on County projects	Actual Expenses	Article VII.B
The field inspection rendered by the City on County projects	Actual Expenses	Article VII.B
The installation and repair of water meters and the investigation of complaints within Baltimore County	Actual Expenses	Article VII.B
The services rendered by the City Water Consumer Service Division for Baltimore County, including postage	Actual Expenses	Article VII.B
The operation and maintenance of the Zonal Distribution Systems within Baltimore County	Actual Expenses	Article VII.B
Water bill processing charges by the City Bureau of Collections	Based on unit cost per bill times number of County water bills	Article VIII.A.1
Water bill processing charges by the City Bureau of Data Processing	Based on unit cost per bill times number of County water bills	Article VIII.A.2
Customer Complaint Processing	Based on the ratio of County water accounts to total water accounts in the system	Article VIII.B
Debt Service for repair or rehabilitation of Raw Water & Treatment Facilities	System Volumetric	Article IX
Debt Service for repair or rehabilitation of Filtered Water Pumping and Storage Facilities	Zonal Volumetric	Article IX
Debt Service for repair or rehabilitation of Filtered Water Pipelines 12" and larger	Flow Distribution Method	Article X
Capital Cost Allocation - Future Filtered Water Pipelines	Flow Distribution Method	Article XI
Capital Cost Allocation - Future Filtered Water Pumping Station or Storage Facilities	Incremental Volume Method	Article XI

The annual reconciliation process requires complex analysis to be performed to determine how each of these cost components is allocated to Baltimore County according to the cost basis specified in the agreement. The determinations of cost ratios based on usage by zone, system-wide usage, customer accounts or flow distribution all require calculations using operational data from the City's water facilities, customer usage and billing data from the City's Utility Billing Division and financial data from the City budget and finance operations. This process is detailed in the following section.

Current Revenue Collection and Annual Reconciliation Process

Baltimore City is responsible for the collection of revenue from Baltimore County customers and the determination of the County's allocation of annual expenses. As shown in the figure below, these two elements form the basis for the annual water settlement that is used to reconcile costs between the two jurisdictions. The revenue collection process is discussed in Section 5.1 of this report. This section of the report focuses on the cost allocation process.

Exhibit 5-10. 1972 Water Agreement Cost Share



Several units within the City are involved in the development of the annual water settlement, but the effort is overseen by DPW's Office of Fiscal Management.

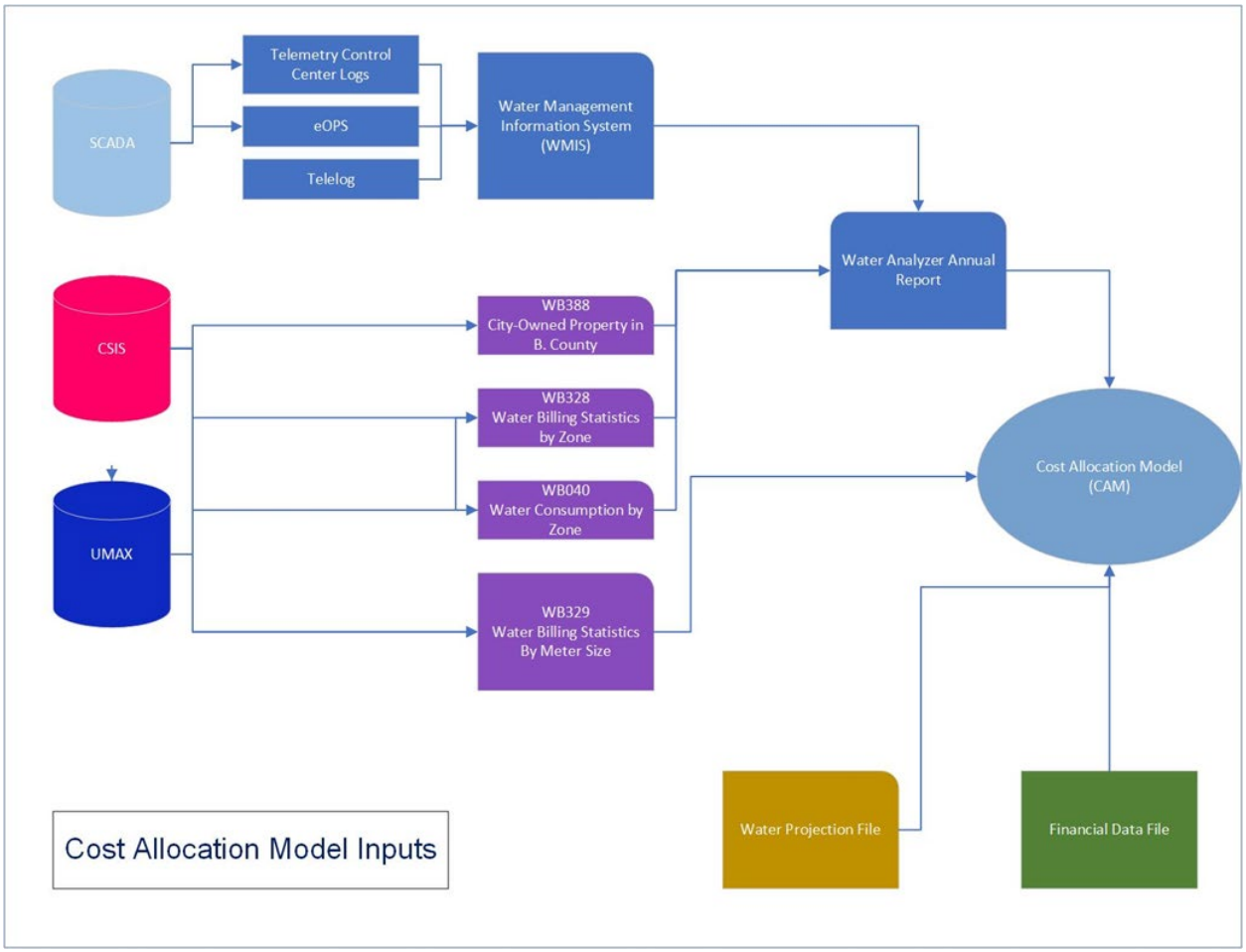
In its current form, the annual water settlement report consists of a 29-page spreadsheet that calculates costs for each jurisdiction. This spreadsheet, which is referred to by City and County staff as the "Cost Allocation Model" (or "CAM"), contains hundreds of formulas and input fields that are used to calculate the County's proportional share of water system operations and maintenance costs using the methodologies specified in the 1972 Agreement.

The inputs to the CAM come from four primary sources:

1. Operational data for various water facilities (treatment plants, pumping stations, etc.) that is generated from various sources within the Environmental Services Division
2. Water usage and billing data for County customers stored in the legacy CSIS mainframe system
3. Water usage and billing data for City customers generated from the newer UMAX customer billing system
4. Budget and expense data generated by various financial reporting systems within the City

A schematic diagram of the flow of data and information into the Cost Allocation Model is shown in the exhibit below.

Exhibit 5-11. Cost Allocation Model Inputs



Key Findings and Observations

Our review of the annual reconciliation process identified six key findings that highlight potential areas of improvement. These findings are based on review of available historical data on past settlements, an archive of inter-jurisdictional correspondence and internal memoranda that was provided at the beginning of the study and interviews of key City and County staff.

Unresolved Disputes over Annual Settlements Dating Back to FY 2014

Our review of historical correspondence and documents provided by both the City and County reveals that there has been a significant, ongoing dispute about annual water settlements going back to FY 2014. The City and County both provided data on final Cost Allocation Model runs for FY 2014 through FY 2018, and while there are small differences between what the City and County have respectively reported as a final settlement figure, there were fundamental questions and concerns that were raised by Baltimore County in a July 2015 letter that have never been resolved. The issues that the County raised during its review of the FY 2014 water settlement included:

- Excessive adjustments to County customer accounts
- Excessive zero readings
- Billing impacts from the installation of AMR meters
- The ongoing City Comptroller's audit of City billing practices

- The policies and processes being used to adjust disputed County water accounts

Despite exchanging numerous letters and meeting several times to attempt to address the issues and concerns raised by the County, there has been no apparent resolution to the FY 2014 water settlement, and no final reconciliation of any subsequent water settlement has taken place since then.

City and County fiscal staff have reported that the actual transfer of funds (which is required under the 1972 Agreement to be completed within 60 days of the transmittal of the annual settlement) has been on hold for the past six years. Both jurisdictions estimate that approximately $20 million in total water settlements remains to be resolved. A summary of outstanding water settlements is shown in the exhibit below.

Exhibit 5-12. Outstanding Water Annual Settlements

Settlement	City Position [1]	County Position [2]	Difference
Fiscal year 2014 (7/1/2013 - 6/30/2014)	$ 5,466,002.28	$ 4,830,225.00	$ 635,777.28
Fiscal year 2015 (7/1/2014 - 6/30/2015)	15,475,297.75	15,461,268.00	14,029.75
Fiscal year 2016 (7/1/2015 - 6/30/2016)	2,371.710.61	2,267,761.00	103,949.61
Fiscal year 2017 (7/1/2016 - 6/30/2017)	(2,652,934.29)	(2,652,934.00)	(0.29)
Fiscal year 2018 (7/1/2017 - 6/30/2018)	(5,297,849.93)	(5,293,546.00)	(4,303.93)
Fiscal year 2019 (7/1/2018 - 6/30/2019)	In Progress		
Fiscal year 2020 (7/1/2019 - 6/30/2020)	In Progress		
Totals	**$ 15,362,226.42**	**$ 14,612,774.00**	**$ 749,452.42**

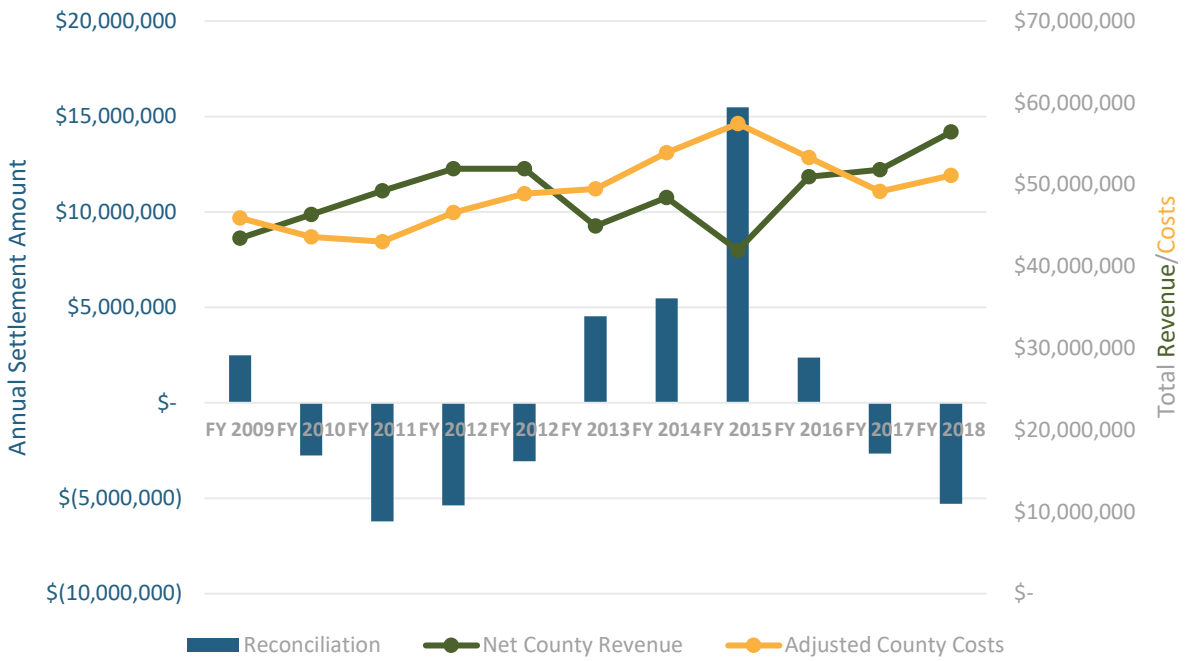
NOTE: Negative values reflect amount owed by Baltimore City to Baltimore County

SOURCE:
1 "CAM History.XLS" provided by DPW Finance on 11/10/2020.
2 "Outstanding Water True Ups 10302020.XLS" provided by County on 11/19/2020.

Large, Unexplained Changes in Billed Revenue and Allocated Costs

Based on a ten-year summary of water settlements provided by Baltimore City DPW fiscal staff (shown in the exhibit below), there have been significant year-to-year swings in both billed County revenue and allocated costs. Changes in either of these values will have a significant impact on the final CAM-generated settlement. For instance, a 13% decrease in County billed revenue in FY 2015, coupled with a 7% increase in allocated costs, resulted in the County owing to the City over $15,475,000. By the next fiscal year, however, revenue had rebounded by 21%, and allocated costs declined by 7%, resulting in a County deficit of only $2,371,000 for FY 2016.

Exhibit 5-13. Annual Water Settlement FY 2009 to FY 2018



The project team reviewed numerous letters, memoranda and emails that chronicle both jurisdiction's attempts to reconcile and explain the wide swings in revenue and cost allocation settlements that occurred between 2014 and 2018, but it is evident that neither the City nor the County ever reached agreement on the final settlements.

Identified Issues and Recommendations Remain Unresolved

In 2018, Baltimore County hired Baker Tilly, a national financial management and accounting firm, to perform a financial and performance analysis of the City's water billing and operations. The scope of this review included an assessment of the business processes and internal control environment in the City's water billing functions, identification of root causes of billing discrepancies and recommendations for improvement.

Baker Tilly issued their final report in December 2018. Among the 47 discrete findings that were identified in the report were several that specifically related to the Cost Allocation Model and annual reconciliation process. These findings included:

- The current CAM reflects the methodology described in the 1972 Agreement and Arbitration
- There are unexplained variances in water revenue billing data and summary reports
- Support for several expense inputs could not be identified
- There was evidence of incorrect data entry
- Several formula links between tabs in the CAM spreadsheet were not working
- Several formulas were overwritten with static data
- Numerous errors found in the Asset Input & Allocation section of the model
- Data omissions were found in several areas of the spreadsheet
- Data in the model did not match source reporting

The City's financial consultant concurred with 37 of the 47 key findings, and Baker Tilly recommended that the City should work with its financial consultant to correct CAM errors, particularly those related to cost allocation for new assets.

Our review of the latest Cost Allocation Model data verified that many of the issues that Baker Tilly identified had not been corrected. Subsequent interviews with City and County staff indicated that while there was a general consensus that changes to the CAM are needed, further guidance and direction are needed from senior managers to implement these changes.

Little Expertise and Institutional Knowledge Remains Regarding Legal Obligations Enumerated in the 1972 Water Agreement and Subsequent 1991 Arbitration Decision

Our interviews with key City and County staff who are involved in the annual reconciliation process revealed that there are only a few individuals who have a technical understanding of the annual water settlement process and no single individual with a comprehensive understanding of how the framework outlined in the 1972 Water Agreement relates to the CAM. The City appears to be 100% reliant on its financial consultant to update the Cost Allocation Model annually, and there are few County staff who are capable of performing a thorough review of the inputs and outputs of the CAM.

Neither jurisdiction could provide written, up-to-date documentation of the water settlement process, and there was no evidence that either jurisdiction maintained standard operating procedures, system documentation, source data inventories or quality assurance/quality control procedures related to the annual reconciliation process. The implication of this finding is that it will be very difficult to maintain an accurate annual reconciliation process as the organizations lose institutional knowledge.

Known Errors and Inconsistencies in CAM-Data Reporting Processes Lead to a Complex, Error-Prone Annual Reconciliation

The City's implementation of the new UMAX billing system, the move to a monthly billing cycle for City residents and the installation of AMI/AMR technology for meter reading had significant impacts on the data streams that the CAM relies on to generate accurate settlements. From interviews with key staff and a review of correspondence between the City and County for the past five years, it is apparent that there was insufficient consideration of the data reporting needs to support the CAM process when these changes were made to the metering and billing system.

Below are some of the reporting and data issues that have been identified by County staff:

- Consumption and billing records reside in two different systems (CSIS, UMAX), so information needs to be merged before entering into the CAM
- The nomenclature used to describe customer accounts is different in both systems
- UMAX and CSIS report account totals differently
- Billing adjustments are recorded differently in UMAX and CSIS
- The accuracy of flow meter data being reported from the City's SCADA system is questionable
- It is difficult to perform QA/QC on data from the SCADA system because information must be tabulated manually from paper logs
- SCADA data was lost when the City's eOPS system was replaced
- There are limited historical reporting capabilities with the City's SCADA data
- The Water Management Information System, which is a critical input into the CAM process, is not automated, and data has to be manually typed into Excel reports
- The development of the WD10 annual report by the Water Analyzer Office has to be done manually and is prone to errors

- Critical data, such as raw water usage information from Harford and Carroll Counties, is occasionally not transmitted
- Data must be input into CAM manually
- The City does not document or reference the sources of financial data inputs to the CAM
- Billing and consumption data from UMAX and CSIS must be manually adjusted and merged to generate the WB 329 input to the CAM
- The assumptions used in the CAM are poorly documented, and their validity is difficult to verify

The implication of this finding is that sources of errors have been introduced into the Cost Allocation Model, which is the sole basis of determining how annual costs are allocated between the City and County, but the impact of these errors is not known. A comprehensive audit and technical review of all data sources will be required to estimate the overall impact of these errors on current and future settlements.

No Structured QA/QC Standard or Process in the Annual Reconciliation Process

Based on discussions with staff and our review of the data streams that are used in the CAM, there is no evidence that the City exercises a preliminary quality assurance review of any of the major data sources that are used to develop the annual settlement. It appears that both jurisdictions rely exclusively on the Water Analyzer Office's review of the preliminary CAM report to flag issues and data problems.

This problem is particularly apparent in water consumption and billing data streams that are used in the CAM. The County has, on numerous occasions, requested explanations for data anomalies that were found in the annual billing and consumption reports that are used in the CAM. This information does not appear to go through a review on the City side prior to being transmitted to the Water Analyzer Office.

Having a robust QA/QC process for all major CAM data sources would improve the accuracy of water settlements and, potentially, allow technical disputes to be resolved earlier in the reconciliation process.

Alignment with Industry Standards and Benchmarks

The relationship between the City and County with respect to how costs are reconciled is somewhat unique because there are aspects of the City's supply of water services that are implemented on a retail basis (metering, billing and customer service of County customers), and aspects that resemble a wholesale relationship.

Although there are no specific industry standards or benchmarks that directly apply to the type of relationship that exists between the City and County, there a number of principles that we believe can be used to guide future improvements to the annual reconciliation process. These principles include the following:

- **Timeliness** – The reconciliation of costs between jurisdictions has implications on budgeting, financial planning, expenditure controls and rate setting and should be completed as quickly as possible after the close of the previous fiscal year so adequate planning can take place.
- **Financial Accountability –** There should be a straightforward process for certifying that the determination of the annual settlement was done in accordance with the requirements of established laws, regulations, rulings and agreements. Audits should be periodically undertaken to verify that applicable financial principles, methods and assumptions are being used in the settlement process.
- **Dispute Resolution** – There should be a process to resolve disputes (including technical disputes) in a timely manner.
- **Quality Control** – The process should have built-in controls to ensure that data used to develop financial settlements meets minimum standards for accuracy and include documentation or certifications to provide an assurance of quality.

- **Continuous Improvement** – The annual reconciliation process should be subject to a formalized, structured and periodic review and assessment to ensure that procedures, methods and assumptions are kept up-to-date and align with organizational, financial and operational changes over time.
- **Sustainability** – The process should be well documented to ensure that each jurisdiction can fulfill its obligations regardless of staffing, technology, organizational or policy changes that may occur in the future. Sufficient resources must be committed to the annual settlement process to ensure that adequate technical support is provided and staff are adequately trained to perform all aspects of the reconciliation process.

Based on our review of the City and County's current implementation of the annual reconciliation process, we have identified a number of areas where opportunities exist to improve the timeliness of the annual settlement, enhance financial accountability, resolve conflicts and disputes more quickly, assure quality, keep the Cost Allocation Model current and assure that each jurisdiction can execute their roles and responsibilities now and into the future.

These opportunities are presented in the exhibit below.

Exhibit 5-14. Alignment with Key Principles and Opportunities for Improvement

Principle	Alignment	Opportunity for Improvement
Timeliness	The 1972 Agreement proscriptively requires the City to submit the water settlement for the previous fiscal year by December 31 of the same year and for the parties to remit the settlement within 60 days after the completion of the settlement. The City and County appear to be on a current schedule that is six months to a year behind.	Identify current bottlenecks and impediments that are delaying the completion of the annual settlement. Develop a process to allow estimated payments to be made in lieu of a final agreement on the total amount owed.
Financial Accountability	There are few documented controls in place to ensure that the input and outputs of the Cost Allocation Model are accurate and consistent with the requirements of the 1972 Agreement.	The City and County should periodically perform an independent audit of the annual settlement. This will improve confidence that the CAM is producing accurate results.
Dispute Resolution	There is no process short of arbitration to resolve ongoing technical and non-technical disputes. As a result, settlements dating back to FY 2014 have not been finalized.	Establish a standing City-County workgroup to work on areas of dispute on a continuous basis. Develop criteria for moving issues to arbitration if unresolved within a specified timeframe.
Quality Control	There is no preliminary quality assurance review of any of the major data sources that are used to develop the annual settlement. It appears that both jurisdictions rely exclusively on the Water Analyzer Office's review of the preliminary CAM report to flag issues and data problems.	Having a robust QA/QC process for all major CAM data sources would improve the accuracy of water settlements and, potentially, allow technical disputes to be resolved earlier in the reconciliation process.
Continuous Improvement	Baker Tilly identified 47 discrete areas of improvement with the Cost Allocation Model and annual reconciliation process in 2018. As of 2020, few, if any, of these issues have been addressed.	Assign personnel or a contractor to continuously work on implementing required changes to the Cost Allocation Model as they are identified.
Sustainability	There are only a few individuals who have a technical understanding of the annual water settlement process, and no single individual with a comprehensive understanding of how the framework outlined in the 1972 Water Agreement relates to CAM. The City appears to be 100%	Identify a broader range of staff to receive training on the true-up process and the Cost Allocation Model. Develop and maintain documentation and standard operating

Exhibit 5-14. Alignment with Key Principles and Opportunities for Improvement

Principle	Alignment	Opportunity for Improvement
	reliant on its outside consultant to update the Cost Allocation Model annually, and there are few County staff who are capable of performing a thorough review of the inputs and outputs of the CAM. Neither jurisdiction could provide written, up-to-date documentation of the water settlement process, and there was no evidence that either jurisdiction maintained standard operating procedures, system documentation, source data inventories, or quality assurance/quality control procedures related to the annual reconciliation process.	procedures for the entire annual reconciliation process.

Task 5.3 City-County Data Transfer

Scope

The project team was requested to review the existing processes and protocols with respect to data transfer between the City and County for the metering and billing operations to enable a better understanding of the current framework and evaluate opportunities to enhance efficiency. Specifically, the project team was requested to perform the following scope of services for this subtask:

- Summarize the existing types of data that are transferred, the source of the data, the systems and mechanisms used in the transfer of data, and other parameters, including the frequency of transfer
- Provide objective observations on the strengths, constraints, risks, and opportunities for consistent and reliable data exchange and for COOP in the event of information system disruption

Methodology

The project team conducted a high-level review of the City-County data transfer processes by examining information from the primary sources:

- Technical documentation, including diagrams of data flows between City and County systems, provided by the County
- Example reports and data files from previous reconciliations
- Interviews with key staff in the County's Metropolitan District Financing & Petition Office

It is important to note that the scope of our review was focused on identifying potential deficiencies with the process that the two jurisdictions use to exchange data and information that is required by the County to issue sewer bills to County customers. An analysis of the data exchange that occurs to support the annual cost reconciliation is presented in *Task 5.2 County Water Service Revenue Collection and Annual Reconciliation Process*.

Our analysis did not examine the hardware and software that the City and the County use to transfer data files used by Metro's billing staff, nor did we examine underlying routines and data transformation methodologies that are embedded within each jurisdiction's information management systems.

Current Data Exchange Process

As was discussed earlier, Baltimore City measures consumption, sends out water bills and collects revenue for water supply services directly from City and County customers. The City bills City customers for water and sewer services on the same monthly bill. The City bills County customers once per quarter for water service only.

The City maintains City customer usage and billing information in the UMAX customer billing system, which replaced the mainframe-based CSIS water billing system in 2016. The City still maintains County customer usage and billing information in the legacy water billing system.

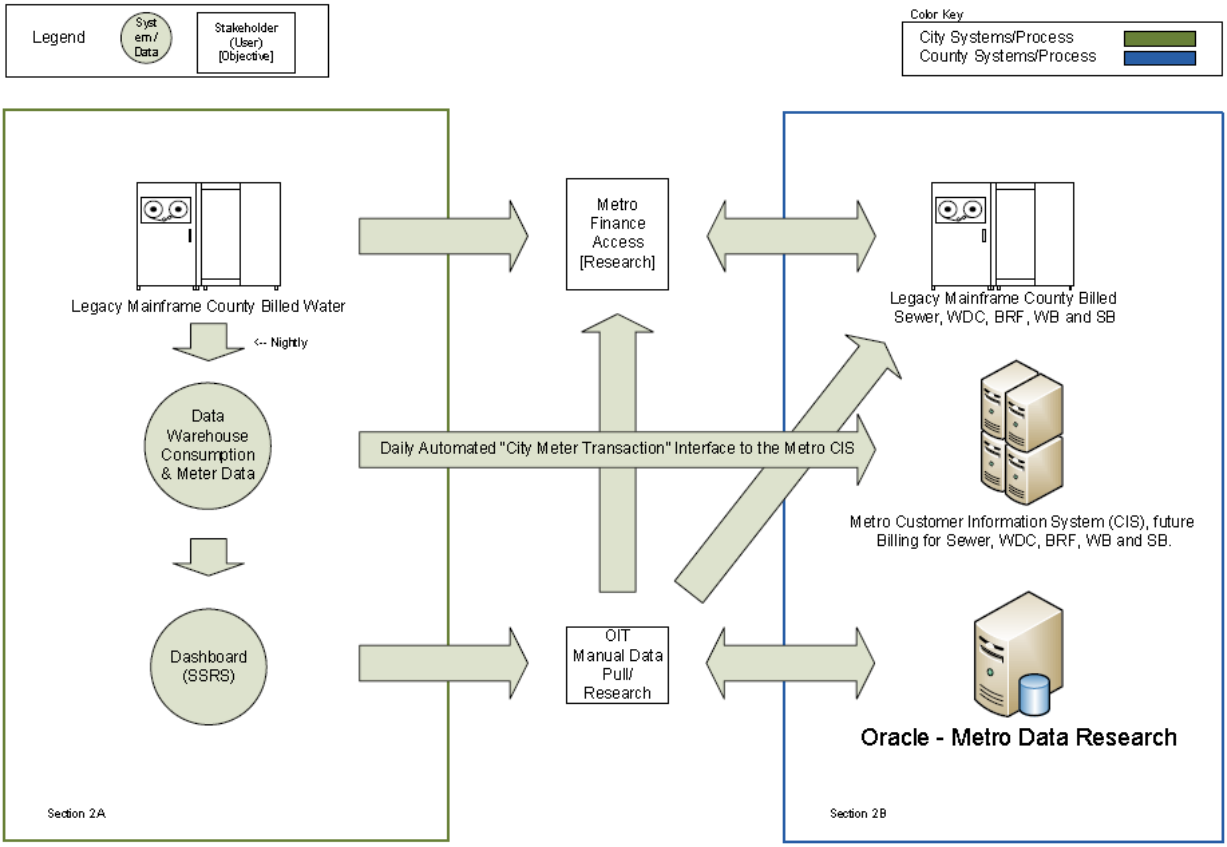
The County uses water consumption and billing information for County customers to calculate annual sewer service charges. This responsibility resides in the County's Metropolitan District Financing & Petition Office (Metro). The County bills County residents for sewer service on an annual basis through annual property tax assessments. Charges for sewer service (and other utility-related charges) appear on County residents' annual tax bills as "Metropolitan District Charges."

Although the County's approach to generating sewer bills is straightforward and common practice (a customer's sewer bill is based on metered water consumption multiplied by a sewer billing rate), the

County's process has a number of vulnerabilities and deficiencies that have impacted Metro Billing's ability to generate and issue accurate sewer bills to County customers. These deficiencies are presented in the Findings and Observations section of this Task.

A schematic process diagram of the data exchange process was provided by County staff and is presented in the exhibit below.

Exhibit 5-15. Current Metro Finance: Baltimore City/County Water Sewer High-Level Data Flow



As the diagram shows, usage data from the City's Legacy Mainframe billing is "pushed" to Metro Billing's CIS system on a daily basis. This data is used to generate County sewer bills once per year.

There are several other sources of data and reports that are transmitted from the City to the County on a regular basis to support the sewer billing process. A list of City reports that are regularly provided to the County are shown in the exhibit below.

Exhibit 5-16. List of City Report Provided to the County

Report Number	Report Name	Source
CS034	Billing Statistics Summary	City CSIS Water Billing System
CS109	Quarterly Billing Report	City CSIS Water Billing System

Exhibit 5-16. List of City Report Provided to the County

Report Number	Report Name	Source
CS205	Excessive & Credit Bills	City CSIS Water Billing System
CS242	Meter Card Trace Report	City CSIS Water Billing System
DW109	Quarterly Billing (Dashboard)	CSSD SSRS Dashboard
WB040	Water Consumption by Distribution Zone	City CSIS Water Billing System
WB328	Water Billing Statistics by Distribution Zone	City CSIS Water Billing System
WB329	Water Billing Statistics by Meter Size	City CSIS Water Billing System
WB388	City-Owned Property in the County	City CSIS Water Billing System
WB000BC	County Billing Register	CSSD
WB000BI	County Billing Register	CSSD

The process that the City and County established many years ago to support both jurisdiction's utility billing requirements has worked adequately until fairly recently. Our review of historical correspondence indicates that significant problems with the data transfer process were being found as early as 2009 and became much more serious in 2014.

The problems that were pointed out in 2009 and 2014 by Baltimore County highlight how interconnected and dependent the County's sewer billing process is on the City's water meter and billing systems. When a high percentage of County customers are receiving accurate water bills on a regular basis, and billing adjustments and corrections are kept at minimum levels, the County's process works well.

When there are major disruptions to water billing for County customers, such as changes in the billing cycles, large changes in billed consumption, high volumes of contested bills, large numbers of adjustments or large numbers of unbilled accounts, these disruptions carry over into the County's sewer billing process.

We have identified several key vulnerabilities with the City and County's approach to data exchange to support the County's sewer billing process. The vulnerabilities are presented in the following section.

Key Findings and Observations

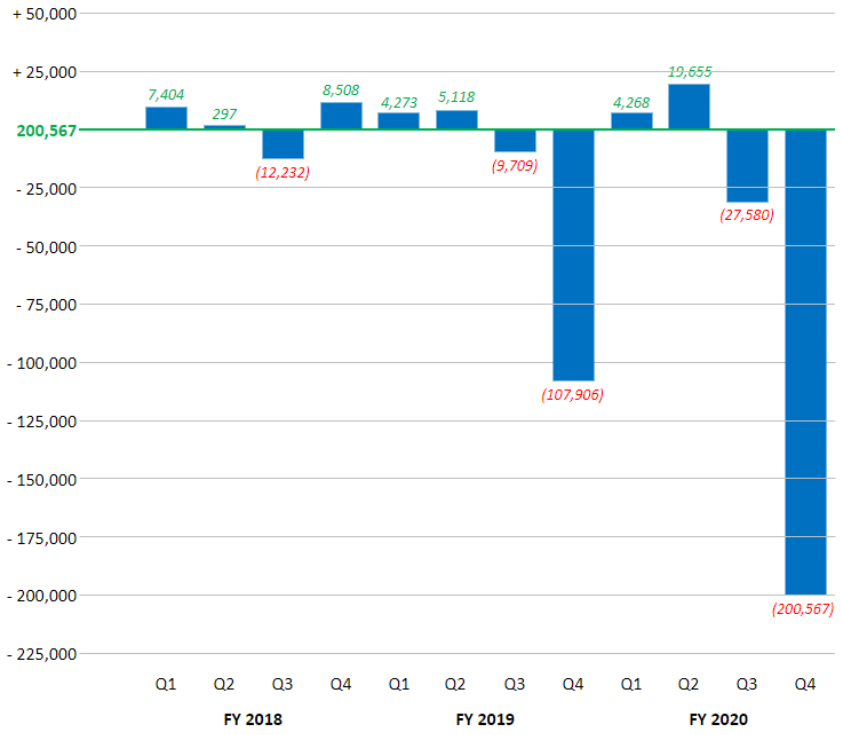
County's Process is Dependent on the City's Outdated, Unsupported Legacy Billing System

The County's sewer billing process is built around a set of assumptions about the capabilities of the City's billing system and the staff that support the system. The City's implementation of the new UMAX system was based on a recognition that the legacy CSIS billing system could no longer support the needs of the CSSD Division, particularly with the transition to AMI meters and monthly billing.

During the implementation of the new UMAX water billing system, the County raised a number of concerns about the impact of the new system on County customers. A September 12, 2018 letter from County DPW Director Steve Walsh to City DPW Director Rudy Chow highlighted the County's concerns about the impacts of moving to monthly billing, reported billing problems experienced by City customers when they transitioned to the new system and concerns about the County's ability to use City water consumption data from the new system to generate sewer bills. Many of these issues have not been fully addressed, and the County continues to have concerns about a migration to the new billing system. Both jurisdictions will need to take a critical look at the current data sharing process to ensure that the County's needs and requirements to support its sewer billing function are considered when a full transition is made to UMAX.

No Continuity of Operations Plan/Disaster Recovery Plan has been Developed

The exhibit that was presented in an earlier section of this report (copied below for reference) reveals two significant disruptions in City meter reading operation over the past year and a half that had a major impact on the County sewer billing process. The latest disruption (the COVID-19 related stoppage of meter reading activity in the County) began in the third quarter of FY 2020 and has continued well into FY 2021. It is unclear how the County will be able to issue sewer bills for accounts that have not been read or billed since last March.



Although it is difficult to anticipate how rare events like the ransomware attack and the global pandemic could be anticipated, neither the City nor the County appears to have developed any contingency plan for the data exchange process.

Developing contingency plans to ensure that all aspects of the customer billing and County data sharing processes can continue despite disruptions to systems, people, infrastructure or facilities should be an integral part of the utility's emergency response planning efforts. Risk management planning that ensures the security and resiliency of resources, facilities and service delivery systems (while including disaster readiness and emergency operations) is a best practice for water and wastewater utilities.

Timing of the City's Key Data and Report Transfers is not Aligned with the County's Schedule

One of the features of the current data exchange process is that the transmission of key reports and the resolution of customer adjustment data make it difficult, if not impossible, for the County to completely address and resolve customer usage changes before sewer assessments are sent to customers.

Fiscal staff in both the City and the County report that the transmission and review of annual reports used to finalize the annual water settlement are approximately a year behind. This means that the Water Analyzer Office's review and reconciliation of annual consumption figures, which is often when the first close examination of County water consumption data takes place, is not being performed early enough in

the process to identify when and where sewer revenue shortfalls may take place due to billing delays by the City.

This finding is somewhat related to the previous finding because estimated billing would help normalize revenue when meter reading activity is disrupted for extended periods of time, as it has during the COVID-19 pandemic.

The County is Unable to Make Decisions Regarding Sewer Billing Adjustments Due to the City's Inconsistent Documentation

Our review of historical correspondence between the City and County revealed concerns regarding large numbers of adjustments to County customer accounts. The County's examination of selected accounts with adjustments raised many questions about why a billing adjustment (usually downward) was made. Although the City's adjustment SOPs require written requests and various documentation, as well as supervisory approval, these records are typically stored in files within CSSD and are not attached to the customer record.

Metro Billing's inability to access this documentation makes it difficult to approve any associated adjustments to sewer bills, particularly in cases where the City cannot provide a clear rationale for the adjustment.

No Formal QA/QC to Identify and Correct Data Anomalies or Reporting Errors

We could find no evidence that reports and data that are transferred and used by the County for sewer billing are subject to a preliminary screening or review by City personnel prior to transmission. The City does not have a documented, formal QA/QC process to ensure that customer consumption and billing data have been checked and verified or that CSSD staff are consistently following established SOPs related to how customers' accounts are changed and appropriately documented within the CSIS system.

City SOPs Related to Billing of County Customers do not Require Input from County

Our review of CSSD's numerous and detailed SOPs did not include any procedures to notify, consult or provide information to any Metro Billing staff, even in cases where account changes or corrections are being made.

Given how dependent Metro Billing is on how CSSD operates, it is likely that SOPs could be improved and the process made more effective if the County and City worked closely together to ensure that critical processes were being followed.

No Established Performance Standards to Transfer Timely and Accurate Water Data from the City to the County

We found no evidence that the City or County has established any mechanism for monitoring the data exchange process on a continuous basis. Given the close working relationship between CSSD and Metro Billing and the importance of this process on the County's financial standing, it seems logical that both groups would, by now, have developed a clear, mutual understanding of the roles, responsibilities and expectations that will govern this business relationship.

Implementing a few simple key performance indicators and quality standards for key aspects of the data transfer process would help managers in both groups develop more confidence that the process is working as intended. Potential KPIs for this function include:

- Date milestones for the transmission of all reports and data streams
- QA/QC metrics, such as the number of adjustments reviewed and audited for consistency

- Tolerances for annual consumption or billing changes that would prompt a further review

Opportunities for Improvement

We have identified several discrete areas of improvement based on the findings presented earlier. We believe that there are clear opportunities to improve the current City-County data interchange process through additional investments in IT infrastructure, development of a continuity of operations plan for the County's sewer billing process, alignment of reporting schedules to coincide with the County's schedule for issuance of tax bills, improvements as to how information about account changes is shared, implementation of QA/QC procedures, integration of inter-jurisdictional communications and coordination into current CSSD SOPs and incorporation of performance measurement principles into City-County business relationship.

These opportunities are presented in the exhibit below.

Exhibit 5-17. Alignment with Key Principles and Opportunities for Improvement

Category	Finding	Opportunity for Improvement
IT	The County's process is dependent on data from the City's outdated, unsupported legacy billing system.	Modernize current systems to automate data transfer process and align system reporting with the County's sewer billing process.
Continuity of Operations	The City and County have not developed a continuity of operations plan or a disaster recovery plan that ensures that County sewer bills can be generated if there is a disruption to customer billing operations in the City.	Work cooperatively to develop contingency plans to address potential disruptions to the data streams.
Schedule Alignment	The timing of key transfers of data and reports is not aligned with the County's schedule for recording metropolitan district charges on County tax bills.	Identify current bottlenecks and issues preventing the timely submission of water consumption and billing data.
Information Sharing	Inconsistent documentation on adjustments impedes the County's ability to make decisions about sewer billing adjustments.	Develop and enforce clear procedures for documenting account changes. Consider implementing an audit trail in the adjustment process to demonstrate compliance with adjustment policies.
Quality Control	The existing data interchange process has no formal quality assurance/quality control mechanism to identify and correct data anomalies or reporting errors before the information is transferred from the City to the County.	Develop and implement a robust QA/QC procedure to ensure that water billing data and information that is regularly transferred from the City to the County is certified for accuracy.
Coordination	CSSD's SOPs related to billing of County customers do not require input or consultation with the County's Metro Billing Office.	Consider modifying existing SOPs or creating new SOPs to facilitate better coordination between CSSD and Metro Billing on account modifications and policy changes.
Performance Measurement	No performance standards have been established or implemented to evaluate how the City is fulfilling its obligations related to the timely transfer of accurate water data to support the County's financial reconciliation process.	Identify and implement key internal performance measures for the data exchange process.

Task 5.4 Customer Service Performance

Scope

The project team was requested to review the existing approach that the City and the County use respectively to provide customer service, including any coordinated efforts. Specifically, the project team was requested to perform the following scope of services for this subtask:

- Review and summarize existing processes and policies that govern each entity's customer service operations, including joint efforts
- Benchmark the performance measures specific to customer service operations, tracking, and reporting on those measures, including analytics

Methodology

Our review of customer service functions under this task was focused on understanding how the City's Customer Service & Support Division and the County's Metropolitan District Finance & Petitions Office (Metro Billing) help County customers resolve water and sewer billing issues, particularly those related to billing errors, leaks and adjustment requests.

To gain an understanding of the processes and issues related to customer service, several Microsoft Teams or phone interviews were conducted with various levels of both City and County customer service staff. When interviews could not be conducted, pre-defined interview questions were sent to the appropriate staff via email communication.

The project team also requested documentation related to customer service-related functions within CSSD and Metro Billing at the initiation of the project. The City provided extensive documentation on standard operating procedures used within CSSD but did not provide any performance data that could be used to benchmark customer service delivery within the unit. The County provided limited process documentation but transmitted extensive data on call ticket resolution within Metro Billing.

Approach to Customer Service

Baltimore City – Customer Service & Support Division

County customers with water billing problems are directed to contact the City's Customer Service & Support Division.

The City's Customer Service & Support Division maintains written standard operating procedures for most customer service activities, including new account activation, billing adjustments, customer assistance program applications, billing inquiries and processing turn-off and turn-on requests. The 75 SOPs that we reviewed appeared to be detailed, thorough and clearly written.

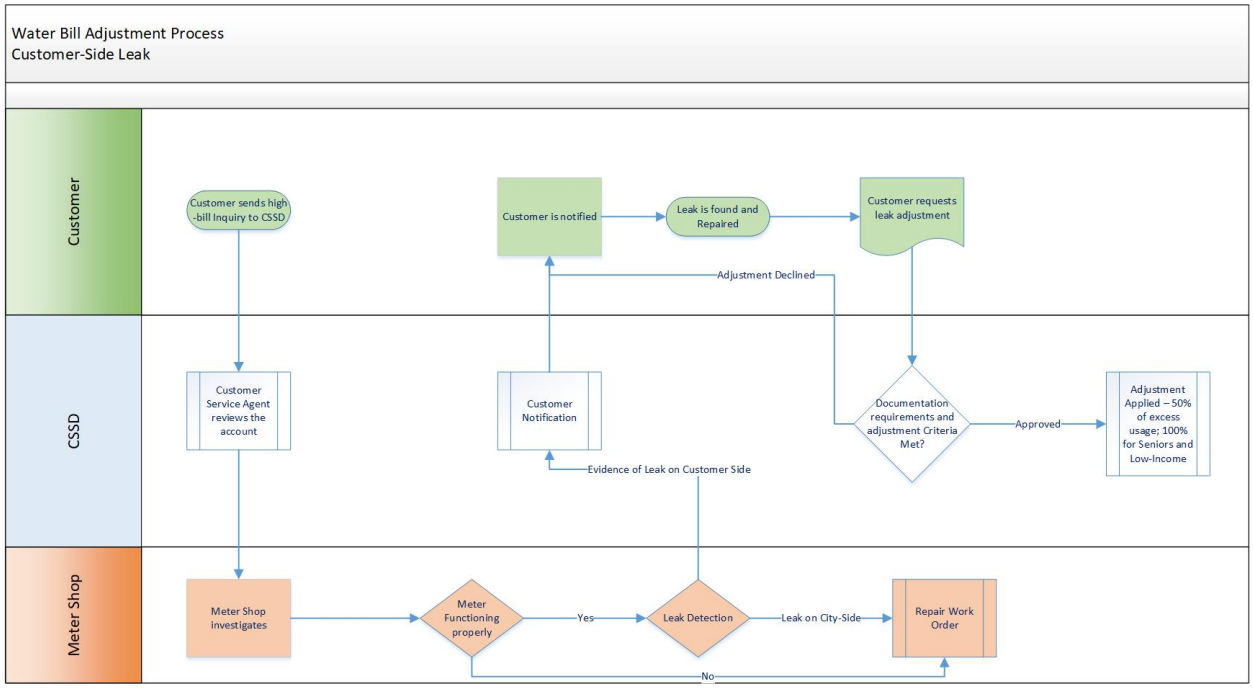
A common customer service scenario for CSSD begins with inquiries from customers who receive bills that they think are high. A typical complaint would start with a call to CSSD via their main phone line (410-396-5398), where the call would be routed to a CSSD customer service agent who will check the status of the account and, depending on the level of increased consumption, generate a meter inspection work order to have the Meter Shop field staff go to the customer's premise and check the condition of the meter. If a leak is suspected, the inspector will attempt to determine the source of the leak.

The SOP for these types of investigations indicates that the field service representative should conduct a thorough assessment of the meter, the ERT and the vault. If there are any problems that require follow-up maintenance, the field technician will initiate the creation of additional work orders for repairs.

Customers with known leaks may receive an excess usage credit of up to 50% of any metered consumption beyond the average for the account (100% for low income or senior customers) for up to two billing cycles of high bills if the request for adjustment is made within 60 days of the receipt of the first high bill. Customers are also required to submit documentation to demonstrate that they repaired the leak.

This customer service example is diagramed in the exhibit below.

Exhibit 5-18. High Bill Adjustment Due to a Leak



Although CSSD staff have indicated that they routinely track customer service metrics, the Division did not provide a response to our request for data on customer call handling (call volume, wait time, abandoned call, etc.), customer service requests and inquiries, resolution time for customer issue or any other operational data summaries that could be used to assess service delivery effectiveness.

Baltimore County – Metro Billing

Baltimore County's Metro Billing Office handles customer inquiries related to any Metropolitan District charges that appear on customer's annual property tax bills.

Because the calculation of sewer service charges is done annually and is based on water usage from the prior year, the process of investigating and resolving billing disputes related to excess sewer service charges is very different than the City's process.

When a sewer billing adjustment is requested, Metro Billing must examine historical billing records and determine if there is a legal basis for the adjustment. Under Baltimore County's regulations, leak adjustments are only given in cases where the leakage did not enter the sewer. To make this determination, Metro Billing personnel must develop a complete understanding of any adjustments that

were approved by the City CSSD unit and examine documentation that was provided by the customer to determine if a sewer service credit is warranted.

There is a myriad of other potential reasons why Metro needs to have a clear picture of how and why account changes are being implemented with CSSD on Baltimore County accounts. This means that both units are dependent on each other to support the customer service process end-to-end.

Metro Billing routinely tracks the volume of customer calls it receives. These are tracked as "call tickets," and the unit maintains daily, weekly and monthly data on open tickets, closed tickets and referrals to Baltimore City (escalations). Based on our initial review of this data set, it does not appear that Metro Billing tracks resolution time as an operational metric.

Key Findings & Observations

There is a Significant Backlog of Unresolved County Escalations

When Metro needs to address customer issues and concerns related to water billing for Baltimore County properties, or they are contacted directly by Baltimore County property owners regarding water billing concerns, they create a city "escalation." When this occurs, the ticket in the customer information system remains open, and a manual email is sent to the City Escalation Unit.

Prior to March 2019, the City required Metro to send one email per account. Since March of 2019, the policy was changed to permit one email with multiple accounts if multiple accounts are affected by the same issue. A copy of the email is kept in the Metro office and also appended to the appropriate account in CIS. The City is supposed to send an email notification to the originator upon review and resolution of the issues, so Metro can close the ticket in CIS.

Since December 2017, Metro staff has generated 11,747 City escalations following the above process. Between December 2017 and November 2020, approximately 3,097 (or 27%) City escalations have been completed and closed in CIS. As of November 2020, 8,650 tickets remain unresolved, and the tickets in CIS remain open. County personnel indicated in interviews that a high percentage of escalations have gone unresolved for "years." This was substantiated by the recent December 2020 Inspector General report that found 8,195 escalations have gone unresolved over a year, and some for almost three years. The report also indicated the City was unaware of the backlog. These open tickets can translate into millions of dollars in unbilled or under-billed water and sewer fees for both the City and the County.

CSSD Staff are Adjusting County Water Bills with Inconsistent Documentation, which Makes it Difficult for Metro Billing to Verify

Our review of historical correspondence indicated that the County's concerns about adjustments to County customer bills date back many years. Adjustment errors or unjustified bill reductions result in potential lost revenue to the County and create customer service problems for Metro Billing when customers request sewer billing adjustments after tax bills are issued.

There are Breakdowns in Communications between CSSD and Metro Billing that are Impacting Customer Service

Because of the inter-dependency between the City's water billing functions and Metro Billing's sewer billing processes, effective resolution of customer billing issues often requires coordination and cooperation across jurisdictional lines. Both the December 2018 Baker Tilley analysis and the December 2020 Inspector General report found fundamental communication issues between the City and County. Interviews and reviews of historical information conducted as part of this review confirm those findings.

When CSSD staff become unresponsive to the County's request for documentation or clarification of how a customer billing issue was resolved, service delivery by Metro Billing becomes impacted.

Standard Operating Procedures Exist for Core Customer Service Functions, but There is Little or No Documentation That Procedures are Being Followed Consistently

The inter-dependent business relationship between CSSD and Metro Billing should be reflected in SOPs for procedures that require input, notification or approval of the other jurisdiction.

We have found that both the City and County have existing standard operating procedures that include step-by-step instructions to be used by staff as a guide for work processes. However, each entity has its own standalone SOPs, and we did not find evidence that end-to-end SOPs exist where processes cross over from City to County or vice versa.

CSSD has an extensive library of standard operating procedures, outlining day-to-day operations and step-by-step information on how to execute call scenarios, so customer service representatives can perform duties and handle calls, resolve billing issues and perform adjustments efficiently and effectively. Through our review, we have found that formal templates are used to document procedures for consistency. Each template references the policy associated with the SOP, as well as cross-reference to other related SOPs so the user can easily move from one SOP to another, if necessary.

CSSD standard operating procedures were found to generally align with best practices. Each SOP indicates a title, reference number, originator, approver, origination date and revision date. However, we have found in some instances where SOPS were missing key information such as an approving signature, original creation date and revision date. In total, CSSD provided over 75 SOPs for review, with less than 5% missing information. All SOPs reviewed were documented clearly and concisely.

Interviews with CSSD and Metro staff revealed that further refinement of existing procedures is needed to ensure that the City's water billing and the County's sewer billing processes are fully aligned and support each jurisdiction's customer service goals. A collaborative review of CSSD and Metro standard operating procedures that focus on the linkages between water bill adjustment and sewer billing would be a potential first step in that refinement.

Findings Related to Customer Billing Adjustments Identified in the 2018 Baker Tilley Report Have Not Been Addressed

The financial management firm Baker Tilley was hired by Baltimore County in 2018 to perform a financial and performance analysis of water billing operations for the City. The scope of their review included the customer service aspect of the City's billing operations.

Among the findings that were presented in the consultant's draft report in December 2018 were several that specifically related to customer billing adjustment. These findings included:

- Billing errors found as a result of poor communication between customer service representatives, billing staff and the Meter Shop
- A lack of documentation to substantiate reasons for billing adjustments
- Adjustment forms completed with incorrect or missing information
- Duplicate adjustments performed on the same account
- An over-reliance on manual and paper-based processes that result in inefficiency and increased billing errors
- The legacy system not being robust enough to support the necessary data needed for research of billing and/or adjustments
- Lack of supervisory controls around adjustments through secondary reviews

These findings directly impact Metro Billing's ability to respond to customer inquiries and address sewer billing issues raised by customers who have received water bill adjustments. Interviews with staff revealed that no efforts were made to address the issues raised in the report because the City's former Director of Public Works did not agree with the consultant's findings.

Customer Satisfaction Surveys are Not Conducted

Customer service satisfaction surveys, as a best practice, measures how products and services meet or surpass customer expectations. Understanding what customers value, what services they want and how they perceive rates compared with other utilities is paramount to customer satisfaction.

It appears CSSD may use some form of customer satisfaction as a performance measurement, as they indicated when responding to questions surrounding metrics and KPIs. However, when asked to provide more detail, reports or an example of customer satisfaction surveys, the City was non-responsive.

County personnel advised they understand the importance of customer satisfaction and intended to survey County customers after the implementation of the customer information system; however, due to other priorities, no surveys were conducted.

Benchmarking

We identified the following key performance indicators that would be effective in characterizing the effectiveness of CSSD's and Metro Billing's customer service delivery. These indicators are widely used within the water and wastewater industry, and it was our intent at the beginning of this project to use benchmarking data as a basis for an objective assessment of CSSD's and Metro's customer service functions.

Unfortunately, neither the City nor the County was able to provide the project team with the operational data that is required to calculate these benchmarks, so the qualitative assessment portion of this task could not be performed.

The key performance indicators that best characterize CSSD's and Metro Billing's customer service activities include:

- **Customer Complaint Rate** – This is measured as the number of customer service complaints per 1,000 customer accounts. The 2019 median for combined utilities was 1.7 complaints per 1,000 accounts. The 2019 median for wastewater only utilities was 0.4 complaints per 1,000 accounts.
- **Billing Accuracy** - This is measured as the number of error-driven billing adjustments made per 10,000 bills generated. The 2019 median for combined utilities was 9.8 errors per 10,000 bills. The 2019 median for wastewater utilities was 10.2 errors per 10,000 bills.
- **Call Center Metrics**
  - Average talk time – 2019 median for combined utilities was 3.7 minutes.
  - Average wait (hold) time – 2019 median for combined utilities was 0.5 minutes.
  - Abandoned Call Ratio – 2019 median for combined utilities was 6.5%
- **First Call Resolution** – Percentage of customer complaints that are resolved with one call. The 2019 median for combined utilities was 92%.

Beyond these industry-standard metrics, CSSD and Metro Billing should consider collaborating to develop key performance indicators that fully encompass the roles, responsibilities and expectations for County customer service delivery that each organization expects. For instance, given the concerns that we have highlighted in this memorandum about current adjustment practices, it would be beneficial to establish a

set of performance measures that ensures that adjustments are being made in accordance with SOPs and are being documented in a way that supports validation and review by third parties.

Task 5.5 County's Sewer Billing and Meter Applications Permitting

Scope

The County provides the sewer utility billing, collections and customer service functions within the County jurisdiction. The project team was requested to review the sewer permitting billing and customer service operations. Specifically, the project team was requested to perform the following scope of services for this subtask:

- Review and summarize the existing permitting function within the County
- Define and summarize core functions and critical processes associated with sewer billing
- Provide objective observations on the process used for identifying and resolving exceptions

Methodology

Our approach to this sub-task review anticipated the development of a comprehensive process map of the meter application process, from the initial request to Baltimore County's Department of Permits Approval and Inspections through processing by the City's Meter Shop to the creation of the sewer billing account within Metro Billing.

Due to limited staff availability, we were unable to complete interviews with key PAI and Meter Shop staff to develop a complete picture of the meter permitting process; however, we were able to identify a number of issues and opportunities for improvement that we have documented in the Findings and Observations section of this memorandum.

Current Meter Permitting Process

When new development occurs, water and sewer service must be extended to the property and activated before an occupancy permit can be issued. The installation and physical connection of the property to the public infrastructure (water and sewer lines) is typically the responsibility of the developer. Water and sewer service installation is subject to City and County standards, which govern the size of the service and the meter type.

In Baltimore County, applications for a new water meter are received by the Department of Permits, Approvals, and Inspections, which oversees all private development activity in Baltimore County. PAI routes meter applications to the City's Meter Shop, which supplies the appropriate water meter, and to Metro Billing, which establishes the billing account in the unit's CIS system.

A developer must pay for the meter and receive approval from both the City and the County prior to picking up a water meter for later installation. When the meter is installed, the City is supposed to be notified, and an inspector is supposed to be sent to verify the installation. That verification starts the billing process for the property and adds the meter to the meter reading schedule. We were not able to verify how the current lines of communications work between CSSD, the Meter Shop, PAI and Metro Billing.

Key Findings & Observations

Although this application process seems straightforward and simple, there are numerous deficiencies in the process that make it prone to error. The problems that we found are consistent with the breakdown that resulted in the Ritz-Carlton billing problem and, fundamentally, are a manifestation of a lack of management oversight and accountability.

The Current Process is Reliant on the Transmittal of Paper Applications and Forms

There has been no effort to automate any part of the new meter application process, even though there would be clear efficiencies if even a small investment was made to reduce manual processing of paperwork. Tracking of requests that have been put into the pipeline does not occur, and there is little or no information sharing on pending permits and meter installations between agencies.

The Current Process is Too Complicated and is Not Being Well Coordinated or Managed by a Single Entity

The City has a multi-step development approval process that requires several different units to issue a release for a water meter from the Meter Shop. Again, the status of any specific application is impossible to determine because sign-off and approvals are not tracked. There has been no effort to automate any part of the new meter application process.

Post-Installation Inspection and Certification are Not Occurring Consistently

There is evidence that the post-installation inspection, which is intended to verify that the correct meter was installed correctly at the correct location, is not being performed consistently. This deficiency has led to billing errors and account maintenance problems because ERT registrations and meter serial numbers do not match customer accounts.

There are No SOPs for the Meter Application Process

This is one of the few areas where there is no evidence of a comprehensive inter-jurisdictional SOP, which would ensure that policies and procedures were being implemented correctly.

The Current Process is Reliant on the Transmittal of Paper Applications and Forms

The lack of clear procedures and coordination between the City and County has created the potential for billing delays to properties that have been built and are now occupied, resulting in a potential loss in revenue.

Task 6
REVIEW FIELD OPERATIONS

TASK 6.1 WATER UTILITY FIELD OPERATIONS

SCOPE

The project team was requested to perform the following scope of services for this subtask:

- Review field operations coordination between the City and the County, and any protocols that are specifically pertinent to water main and road restoration.

METHODOLOGY

Based on our interpretation of the scope of work defined by the City and County, our review of field operations was focused on water main repair activities performed by the City's Utility Maintenance Division in Baltimore County. A discussion of water meter maintenance activities performed by Meter Shop personnel is provided in *Task 5.1 Metering and Billing Operations* of this report.

A comprehensive request for information and data was provided to Baltimore City and Baltimore County as a first step in the analysis. Interviews were planned and conducted with City and County Field Operations personnel. Facts documented during the interviews were provided to the interviewees for verification.

Our workplan also included the development of a list of best practices and a comparison of the City and County Field Operations coordination to best practices. The primary source of best practice metrics was AWWA's 2018 benchmarking report. Operational best practices are derived from our experience in performing operations reviews for other large utilities.

This is a high-level review, and the findings and best practices outlined in our report are based on the information and data provided by Baltimore City and Baltimore County.

SUMMARY OF CITY AND COUNTY FIELD OPERATIONS PRACTICES

The following are conclusions using an efficiency, effectiveness and best practice framework.

Exhibit 6-1. Summary of Findings - Water Utility Field Operations

Element	County	City	Comment
Efficiency	▪ In cases that go to the City, there are two investigations: one by the County and one by the City ▪ The County checks to see if the complaint is a duplicate call for same problem	▪ The division of duties requires multi-jurisdictional coordination of two crews: one for water work and one for road work ▪ If referred to the City, the City checks to see if it is a duplicate call for the same problem	▪ County residents' dissatisfaction with the City's responsiveness results in calls going to the County ▪ As a result, the County performs an investigation to determine if complaint should go to City

Exhibit 6-1. Summary of Findings - Water Utility Field Operations

Element	County	City	Comment
Effectiveness	▪ In Fiscal Year (FY) 2019, the median time to address water service disruption for water and sewer utilities was 4.2 hours ▪ The estimated time to resolve problems appears to be well above water utility medians – impacts County customers ▪ The County needs to investigate to make sure it is a water problem and not an SSO or similar issue	▪ A high level of reactive fieldwork (estimated at 70%) results in some problems going unaddressed for a long time, resulting in multiple calls to City 311	▪ City procedures do not allow computation of these metrics, but time to address seems well above the median (4.2 hours)
Best Practice Comparison			
1. Field crew is aware of other activity in area	▪ The City does not always inform the County when working in the County	▪ The City is not always aware of County work in the area	▪ The nature of communications hampers awareness
2. Field crew can access GIS	▪ The County has provided water and sewer GIS access	▪ City field crews cannot access County sewer GIS	▪ Application used by Utility Maintenance crews to access County sewer data needs to be properly configured

Background

Baltimore City owns and operates the water and sewer systems in Baltimore City. Under agreement, the City also owns and operates the water system within Baltimore County and is responsible for maintenance and repairs to the water system in the County. Baltimore County owns and operates the sewer system within the County.

Task 6.2 Customer Complaints addresses customer complaint handling and the reader is referred to that section for the process, which begins with a customer complaint and a phone call to register the complaint with the County.

Under the 1972 inter-jurisdictional water agreement, the City is obligated to handle all investigations and repairs to the water system. According to County Bureau of Utilities staff, beginning roughly six years ago, County residents calling the City could not get answers or get the City to perform the needed work. Due to the inability of County residents to get a response from the City, they now call the County, which sends out inspectors to investigate and correct minor issues that they can handle. Under Metro guidance, personnel were hired to perform the investigations (including a retired City inspector) and send all findings to the City, with detailed instructions on what is needed to correct the issue at hand, as well as instructions on what to correct about anything the current issue affects (such as billing, leak report and proper account information). The County's Metro Billing Division used to rely solely on the City's inspection reports when making determinations on whether to adjust a sewer service charge or not (sewer charges are based on water use). The County reports that it is rare that a City work order is properly documented or contains

all the needed information to justify adjustments to the sewer service charge. It was reported that work orders are often not trusted by the County for their accuracy when it comes to what the problem is or even if the problem was corrected. Many City work orders are just closed with no documentation on what was done.

As noted above, the County may resolve a problem if it is minor (e.g., a meter cover out of place). The County will not perform work that requires digging or involves water mains.

In some cases involving safety issues, the County may have to take some safety-related actions before passing the case on to the City. This can involve bringing in the Bureau of Highways to salt roads in the winter, install fencing and similar measures.

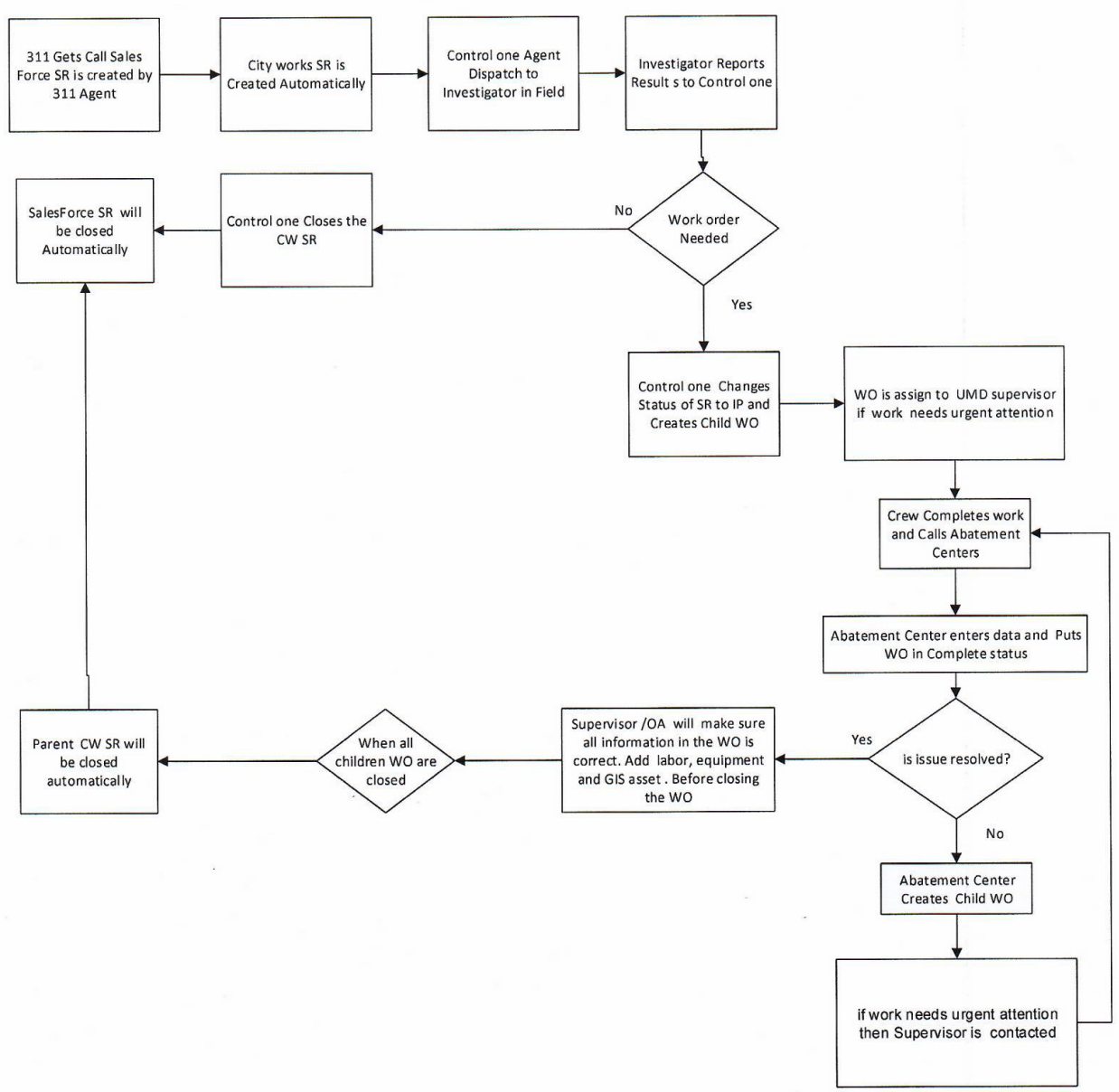
County field investigations related to a water complaint are performed by their Emergency Response Group. The target time to arrive to a field problem is under one hour; in most cases, they arrive within 30 to 40 minutes.

Current Filed Operations Coordination Process

Once an issue is sent to Baltimore City, a confirmation number is received, which is recorded in the County's Cityworks work order management system. The City will typically perform repairs relying solely on its own investigator's report.

The City's workflow when receiving this report from the County is shown in the exhibit below. [NOTE: "311" refers to City 311]

Exhibit 6-2. Process Workflow



WO Work Order
SR Service Request

As part of its procedure, the City sends an investigator. Based on the investigator's evaluation, the work required will be given a category that carries with it a target number of days to repair. For example, valve leaks have a target for repair of 60 days, while service leaks have a target for repair of 30 days. A work order in which a customer has no water is considered an emergency and is addressed right away.

When the City is ready to send a crew out, it informs the County by phone. For large jobs, the County will provide a road crew with a dump truck to haul spoils and other actions that may be required from them. For small jobs, the road crew comes out after the work is finished. However, in an estimated 10-15% of the cases according to the County, the City does not inform the County that a crew is coming out.

A best practice in field operations is to check to see if anyone else is working in the area. The City relies on email communication to know if someone is working in a given area; City contractor activity is provided as a notification email; County Engineering sends out CIP contractor lists etc. There are several breakdowns in this system, such as too many emails and the County informing the City's Office of Asset Management but not sharing with the City's utility maintenance crews. As a result, field crews are sometimes not aware of others working in the area.

Another best practice when performing fieldwork is to be aware of infrastructure in the immediate area. The City can access water infrastructure in GIS. However, the City utility maintenance crews cannot access sewer infrastructure in the County because the two main computer applications that the Division uses to access GIS data (UView and Cityworks) are not currently configured to access County sewers. It should be noted that the City DPW's central GIS operation has access to the County's sewer layer (this was confirmed by the County) even though there is no process in place to regularly update these files (the County noted that the layers the City sees might be out of date).

The "Water Main" list, which is generated by Baltimore City's Utility Maintenance Division, is sent out multiple times each day and identifies the status of each main where the repair crew will be working. The report identifies:

- Location of the main break
- Size of main
- Number of services affected (a service is defined as a meter, not a customer)
- Number of hydrants affected
- Major facilities affected
- Date and time reported
- Crew assigned
- Status
- Area and Council district

County personnel note that the Water Main list is useful but not always kept up to date. No formal processes or procedures require the Water Main list to be kept current, and there is no penalty for failing to do so.

The Chief of the City Utility Maintenance Division has four supervisors who prepare lists indicating where work will be performed, but crews can get redirected by emergencies resulting in the Water Main list not always being current. A process is needed to make certain that the Water Main list is kept current to eliminate delays.

When staff from the City Utility Maintenance Division work in the County, they consider it a joint City-County effort, so typically, the City Utility Maintenance Division does not report complaint status or completion to the County, relying on the County crew to be aware of completion. By reviewing the Water Main list regularly, the County can identify status from the City's standpoint. Since a water main break repair requires County crews for backfilling and pavement restoration to be fully complete, the County knows the City's work is complete by receiving such a request either from the City or from a County homeowner (see below).

Severe winter conditions can affect how water main repairs are performed. County trucks can be tied up having to deal with other problems, requiring the City to bring its own trucks and fill material.

The County knows to close out a case if it is asked to do road restoration or if it is informed of completion by City 311. For smaller breaks, when, for some reason, the County crew is not on-site for road restoration, the City crews will ask the homeowner to contact the County to close. This is an infrequent occurrence,

but the County verifies that it has happened. This is another example of shifting the responsibility for action from the City or County to the customer and does not enhance customer satisfaction.

These examples point to a lack of coordination due to informal communication between the City and County and the lack of an integrated tracking and management system accessible to and used by the City and County. The County notes that a link between the two Cityworks systems would be ideal but is unlikely to happen soon.

Other items noted in interviews indicate points of dissatisfaction:

- City crews asking homeowners to inform the County that work is complete. This happens infrequently but should not happen at all.
- Leaks going unaddressed for as long as six months and only being repaired when the level of communication was escalated to the DPW level. This is also a rare occurrence but indicates the historic lack of regular communication regarding field-related customer satisfaction issues. City-County communications have improved recently, as noted in Task 4.
- County customers refusing to contact the City with a problem due to customer frustration and dissatisfaction related to previous contacts with the City and City crews. This was conveyed by County personnel as the reason for the change in procedures made six years ago that resulted in leak and break complaint calls being directed to the County.

Best Practices in Field Operations

High-performing utilities exhibit the following practices when responding to field problems:

- Utilize metrics to set performance targets and measure performance. Typical field operations metrics include time to problem resolution, disruption of service levels and transactional satisfaction. Most important metrics are either not available or hard to access.
- Identify and notify other crews (utility and contractors) working in the area by the time they arrive on-site.
- Field crews are aware of the location of infrastructure in the area in which they are working.
- Notify customers when the problem is resolved.
- Have a strategy for the efficient use of personnel and equipment. The best strategy will vary from utility to utility based on service area, location of depots, etc. Other field efficiency measures include access to drawings, standard kits per truck, etc.

It was reported that the City's Utility Maintenance Division follows all of these practices but that there was room for improvement.

Opportunities for Improvement

- Since there are no quantitative or qualitative service level measures between the City and County, there are no target performance measures.
- Investigations are performed by both the County and the City. For problems reported by County customers, the County sends out an investigator. If the problem is a water leak or break, the report is forwarded to the City. The City then sends out its own investigator.
- In an estimated 10-15% of the cases, City crews fail to inform the County that they are working in the County.
- The closest to a notification of resolution seems to be the occasional request to affected homeowners to contact the County to complete a repair. It was noted that when City Utility Maintenance crews are working on a break, the City requests a County dump truck and that County officials are onsite to backfill and repair the area immediately.

- Notification to other crews (County and contractors) in the area where a City field crew is working is spotty. Conversely, the City is not made aware of where some County crews and contractors are working. Failure to coordinate activities is common with each the County's and City's field operations.
- City crews cannot access sewer infrastructure in the County's GIS in the area where they are working; however, this is a GIS issue related to shared access/permissions and not a result of the County's failure to provide the information.
- The City would like to be informed when the County has done any water system work. It was reported that this is now a County practice, so, hopefully, there are no problems going forward.
- The County used to rely solely on City reports when making determinations on whether to adjust a sewer service charge or not. However, the County reports that it is rare that a City work order is properly documented or contains all the needed information to make these adjustments, making this information unreliable for sewer service charge adjustments. It was also reported that Metro has stopped relying on City reports for six years.

Task 6.2 Customer Complaints

Scope

The project team was requested to perform the following scope of services for this subtask:

- Review the existing processes and protocols the City and the County respectively follow to manage the value chain from the origination of customer complaint until resolution and customer notification.
- Review and summarize the existing complaint resolution process in the City and the County, including complaint information capture, issues resolution, tracking, activity reporting, and customer notification.
- Provide objective observations on the strengths, issues, and opportunities for enhanced coordination in the case of water and sewer utility-related customer complaints.

Methodology

Like the methodology for *Task 6.1 Water Utility Field Operations*, a comprehensive request for information and data was provided to Baltimore City and Baltimore County as a first step in the analysis. Interviews were planned and conducted with City and County field operations. Facts documented during the interviews were provided to the interviewees for verification.

Our workplan also included the development of a list of best practices and a comparison of the City and County field customer complaint resolution processes to these best practices. The sources of best practices included:

- Research performed for the Water Research Foundation by a member of the project team who was Principal Investigator for "Best Practices for a Continually Improving Customer Responsive Organization "and "Optimizing the Water Utility Customer Contact Center"
- AWWA Benchmarking
- Our experience in performing customer service improvement studies

This is a high-level review, and the findings and best practices outlined in our report are based on the information and data provided by Baltimore City and Baltimore County.

Summary of City and County Best Practices

Exhibit 6-3. Summary of Findings - Customer Complaints

Element	County	City	Comment
Single number in	▪ County customers are now directed by the County website to choose between two County numbers for leaks and breaks and between two City numbers for water quality, meter and hydrant issues ▪ County staff may provide the caller with a number that can reach City 311	▪ City residents are directed to call 311 with complaints	▪ The preferred strategy for customer satisfaction is to have one phone number for complaints/requests for service

Exhibit 6-3. Summary of Findings - Customer Complaints

Element	County	City	Comment
Customer Complaint Information Capture	▪ The County dispatcher follows a script ▪ Before assigning a service request number, a check is made for the same code or similar codes in the area	▪ The City also follows a script ▪ The process has two points so it can catch duplicates	▪ Using a script and checking for duplicates are both best practices
Minimize time to address problems	▪ Water field problems will involve two investigators (one County and one City), delaying start of addressing problems ▪ Fieldwork usually requires one City and one County crew ▪ The County has an optimized investigative function (crew size, kitting and capability) ▪ Because of a high level of reactive work by City Field Operations, it takes a long time to address low-level problems	▪ Only one investigator is sent out ▪ The City has an optimized investigative function (crew size, kitting and capability) ▪ Because of a high level of reactive work by City Field Operations, it takes a long time to address low-level problems	▪ The City and County have both optimized their investigative function (crew size, kitting and capability) ▪ Work in the County is slowed by multiple investigations ▪ A high level of reactive work delays all but high priority work
Tracking and Activity Reporting	▪ A service request number is created in Cityworks (unless a call is a duplicate) ▪ The customer can track progress online	▪ The 311 agent creates a service request ▪ The customer can track progress online	▪ Inter-jurisdictional activity reporting uses the Water Main report ▪ County customers cannot dial 311 and get City 311 (depends on location)
Customer Notification	▪ For "commitment" calls, the customer is contacted by phone when work is complete ▪ In a few cases, the City crew will notify the customer of completion ▪ Otherwise, the customer is not notified	▪ The customer is not notified when work is complete	

Background

Baltimore City owns and operates the water and sewer systems in Baltimore City. Under agreement, the City also owns and operates the water system within Baltimore County and is responsible for maintenance and repairs to the water system in the County. Baltimore County owns and operates the sewer system

within the County. City residents utilize the City's 311 system for water and sewer complaints. A County resident is directed by the County's website to use the following options for water complaints:

Call Baltimore City at one of three different numbers depending on the issue:

- Water billing or water rates: 410-396-5398 (the City's Water Billing Customer Service Center)
- Water meter issues: 410-396-3100 (Baltimore City Hall main switchboard)
- Water quality (such as color, water pressure, etc.): 443-263-2220 (City's 311 Call Center) [NOTE: based on location of the caller, a call to 311 can get them either City 311 or County 311. When County customers call, they are connected with CSSD phone operators, not the 311 operators. The CSSD operators may have different scripts.]
- Water leaking from fire hydrants: 443-263-2220

Call Baltimore County for the following:

- Leaks or water main breaks: 410-887-7415 (the County will confirm the leak is from the water system and notify the City for repairs)
- Water main breaks causing damage to roads or property: 410-887-7415
- Relining projects (if above ground water pipe connections are leaking or damaged): 410-887-3531

Findings

County Complaint Resolution

In Task 6.1, we described the process for resolving water complaints in the County. There is a different process for sewer complaints in the County.

When a sewer complaint call comes in, the following process is undertaken:

- The dispatcher, following a script, identifies the problem (e.g., sewer overflow, blockage, water in basement, other) and obtains the service address and the caller's address (if different), name, number and email address.
- Before assigning a service request number, the dispatcher checks for the same problem code and related codes in the same service area. If it is a duplicate, the information will revert to the original service request number in Cityworks; if it is determined that it is a new problem, a new service request number will be originated.
- The request will be put into the queue. Depending on the time of day, the request will go to the Pipeline Maintenance Division (Monday through Friday from 1:30 am to 4 pm) or the Pump Division (24 hours a day, seven days a week).
- An investigative team is sent out to evaluate the problem and identify the type of crew needed.
- If it is a sewer problem (and not clean water in the basement, for example), a crew will be dispatched.
- Depending on the time of day, the request for a crew will either go to Emergency Sewer Service (6 am to 1 am) or to the Pump Division.
- From the daily sheet, the dispatcher will know if anyone else is working in the area. The crew will have complete GIS access to infrastructure in the area.
- When the crew is dispatched, it will have the capability (if a road cut is required) to do a temporary patch. Final cover will be provided by a road crew at a later time. It is rare for two crews to go to a sewer site at the same time.
- For basement backups, the customer will be given a card for claims with the service request number so the customer can look up what has been done.
- For "commitment" calls (i.e., complaints that have come from the County Council or the Director's office), a call will be made when work is complete. In all other cases, the complainant is not contacted when work is considered complete.

City Complaint Resolution

- In Task 6.1, we presented a flowchart that describes the process for resolving water complaints in the City. Additional steps include:
- The City has a two-pronged approach to check for duplicate calls. The City's utility maintenance work control center (the place where they dispatch, create and close out work orders) evaluates all ongoing work on a real-time basis. As part of that process, they also check for duplicates before creating Cityworks work orders. However, they may issue multiple work orders for the same problem. If that is the case, one of the tasks of the investigators (who operate similarly to construction inspectors) is to know what to look for and how to evaluate duplicate requests. This task was one of the main drivers for creating the investigator class: to eliminate sending multiple crews for the same issue.
- Both the City and County uses Cityworks to track progress on resolving complaints. However, the County is not able to use Cityworks to query or update work orders.
- The City does not notify the customer when the issue is resolved.
- The City does not conduct transactional customer satisfaction surveys to determine levels of customer satisfaction with the process. It should be noted that the City is actively developing a process to gauge customer experience and satisfaction.
- The City accumulates a substantial amount of information as they track field activity from complaint to resolution but does not actively compute and track some key metrics such as disruption of service, time to resolution, etc.

Industry Best Practices in Customer Satisfaction

Some practices and metrics associated with high levels of customer satisfaction include the following.

First Contact Resolution – A first contact resolution (FCR) is a service issue that is resolved in a single response activity (typically, a call or an email). In other words, when a customer service representative (CSR) answers a customer's question on the initial contact, that case counts as a first contact resolution. The median value for FCR for combined water and sewer utilities in the 2018 AWWA benchmarking report was 92%. Being able to calculate FCR would require script and/or call category changes, so we were not able to compute FCR. However, in the 311 report for the first half of 2020, more than 70% of the water and wastewater calls were escalations. While this does not translate to an FCR of 30% (some escalations are likely multiple calls about the same problem, and the 311 report contains both meter and maintenance issues), it is highly likely that the FCR is well below the median. Little emphasis is placed on customer satisfaction, and the processes used to resolve problems appear to be designed to improve ease of administration for City or County employees, rather than focusing on customers.

Single Number In – This is one of the founding premises of 311, an area in which Baltimore was an early adopter, that it is best for the citizen/customer if they have a single contact point to resolve problems. County residents have to choose from five phone numbers to report a problem. One of the numbers (for water meter issues) is the Baltimore City main switchboard. This is not conducive to quick resolution of problems or development of customer satisfaction.

Reduction of Points of Dissatisfaction – High-performing utilities with high levels of customer satisfaction and (usually) low customer service costs per account exhibit the following characteristics:

High Billing Accuracy – in 2018, the median value for the high-performing AWWA benchmarked utilities (combined water and sewer) was 6.0 errors per 10,000 bills (water) and 3.9 errors per 10,000 bills (wastewater). While this is discussed elsewhere in this report, it is safe to say that Baltimore City does not score well in this area. This translates into issues for the County in making adjustments and estimating revenues for budgeting.

Low Disruption of Service Rates – AWWA benchmarking reports 18 different disruption of service rates. The 2018 water and sewer median value for the overall water disruption index (number of disruptions, both planned and unplanned, per 1,000 accounts in one year) was 2.01. For the first six months of 2020, we calculated Baltimore City's disruption of service index to be 3.25. Continued at this rate, the full-year value of 6.5 would place Baltimore in the bottom quartile of AWWA benchmarked utilities.

Fast Response to Disruptions of Service – In the 2018 AWWA benchmarking survey, the median time to resolve unplanned water disruptions of service was 4.2 hours. The City was unable to provide comparable data but noted that the range of time to resolve disruptions of water service was between four and 16 hours, so Baltimore is in either the third or fourth quartile on this measure.

Low Technical Quality Complaint Rates (taste, odor, color, etc.) – The 2018 median value for AWWA benchmarking water and sewer utilities was 9.2 per 1,000 accounts. At 11.5 (extrapolated to a full year from the first six months), Baltimore would place in the third quartile.

Fast Response to Concerns – Utilities with high levels of satisfaction will have excellent call center metrics (e.g., low wait times, low abandoned call rates, etc.) and excellent field response times (30 to 45 minutes). [Note: Call center metrics are addressed further in this report]

Some other practices associated with high levels of customer satisfaction include:

- *Customer Complaint Information Capture*: Use a script and check for duplicate complaints.
- *Issue Resolution:* Send investigators to optimize responses. Optimize investigation crew sizes and equipment on trucks.
- *Tracking and Activity Reporting:* Use case management to track problem resolution to conclusion.
- *Customer Notification*: Satisfy the customer with a positive closeout.

High-Level Observations

Baltimore County Customer Satisfaction Issues

The current system for resolving customer complaints related to field issues is unsatisfactory:

- There are multiple phone numbers for customers to call when they have a problem. A County customer initially has a choice of five phone numbers. One number is for the Baltimore City main operator, resulting in the call being transferred to another number within the City.
- Given the multiple numbers, it is unlikely that County customers will experience a first contact resolution remotely close to the AWWA benchmarking median.
- The multiple billing systems produce a high level of billing errors. The exact number is not available due to lack of a centralized tracking system, but anecdotal commentary related to this important topic was noted in interviews. Billing problems have nothing to do with field operations, but dissatisfaction caused by billing problems has an impact. Some County customers refuse to call the City for field problems.
- The City 311 statistical report does not provide the information needed to compute disruption of service rates – if an activity is not tracked or measured, it is difficult to manage it.
- A separate subtask is analyzing call center metrics. As noted earlier, dissatisfaction with the City can make resolution of field problems more difficult.

As mentioned in Task 6.1, interviews indicated additional points of dissatisfaction. Although infrequent, City crews asking homeowners to inform the County that work is complete; leaks occasionally going unaddressed for as long as six months unless communication was escalated to the DPW level; and due to previous bad experiences, County customers refusing to contact the City with a problem.

This section presents observations when the City and County work separately.

Complaint Resolution

- Both the City and County utilize scripts when receiving a complaint call to identify the problem, service location and other relevant information.
- The County performs checks to look for duplicates. This is a good practice to prevent multiple crews from going out to deal with the same problem.
- The City has a two-pronged approach to check for duplicate calls. The City's utility maintenance work control center (the place where they dispatch, create and close out work orders) evaluates all ongoing work on a real-time basis. As part of that process, they also check for duplicates before creating Cityworks work orders. However, they may issue multiple work orders for the same problem. If that is the case, one of the tasks of the investigators (who operate similarly to construction inspectors) is to know what to look for and how to evaluate duplicate requests. This task was one of the main drivers for creating the investigator class: to eliminate sending multiple crews for the same issue.
- Both the City and the County use Cityworks to track progress on resolving complaints.
- Neither the City nor the County actively notifies the customer when the issue is resolved, except for County "commitment" calls.
- Neither the City nor the County conducts customer satisfaction surveys to determine levels of customer satisfaction with the process.
- Both the City and County accumulate a substantial amount of information as they track field activity from complaint to resolution but do not actively compute and track some key metrics such as disruption of service, time to resolution, etc.

Strengths

- Both the City and the County utilize scripts when calls are received to ensure that they collect the needed information.
- Both the City and County check for multiple calls for the same issue, either from the same address or nearby addresses.
- Both the City and County send out investigators first to analyze a situation and determine the most appropriate response. The City optimized its investigative strategy in 2004. The County optimized investigator crew size and truck equipment shortly thereafter. County trucks carry the necessary safety equipment for confined space entry. The County uses two-man crews since a minimum of two people is required to perform confined space entry to large meter vaults.
- Both the City and County track progress in Cityworks and generate statistics on field operations performance.
- With one exception (noted below in issues), crews have access to necessary GIS data when they go to a worksite.
- With one exception (noted below in issues), crews are aware of other crews (utility or contractor) working in the area.
- The County notifies customers in the case of "commitment" calls when work is complete.

Issues

- County customers must choose between five different numbers when they have a problem.
- The number for water meter issues is the Baltimore City main switchboard.
- For leaks or breaks in the County, the County sends out an investigator for a variety of reasons: make sure it is not a safety issue, make sure it is not an SSO, etc. If it is a water issue, the report is sent to the City. The City, however, then sends out its own inspector (after determining it is not a duplicate issue).
- The City estimates that its work is 70% reactive. Some people interviewed believe the actual percentage is even higher. County personnel estimate that fieldwork in the County is 95% reactive.

Fieldwork that is reactive can take as much as five times as many hours to complete as the same work performed on a planned basis. Since reactive work is so much more expensive than planned work, target values for planned work are 60 to 70%. The 75th quartile for distribution systems for planned work is 63% (2018 AWWA benchmarking). When there is so much reactive work, reports such as the Water Main report can become outdated and small problems, such as leaks, can go uncorrected for a long time and grow into major problems. The City plans that, with its asset management program, it can eventually achieve a target work order distribution of 40% planned, 40% predictive and 20% reactive.

- As for the split of reactive vs. proactive for the County, this is dependent on the time of year. During months following tax bills being issued (July 1), the County is almost completely reactive, as it is responding to taxpayers calling about their sewer service charges. Adjusters in Metro handle and initiate inspection requests to County inspectors. Around the first of the year, the work shifts more to preparing for the upcoming tax bill. After this time, the County becomes 90% proactive, running exemption reports and internal audits.
- Because of the high level of reactive work, the City's Utility Maintenance Division must triage service requests, dealing with the most serious first. The result is a high level of repeat calls regarding the same problem. These calls are considered escalation calls. For the first half of 2020, 80% of the calls going to 311 were escalations. While some of these were calls regarding repairs not performed during the target time interval, many may have been calls regarding minor problems not addressed promptly.
- One important metric for call centers is first contact resolution: the concept that a problem should be addressed, as much as possible, during the first contact the customer has with the call center. The target value for FCR for high-performing utilities is 90%; in 2018, for AWWA benchmarked utilities, the median value for FCR was 90%, while the first quartile was 95%. Based on the first half of 2020, the City's FCR is estimated to be below 20%. Such low values for FCR are associated with high levels of customer dissatisfaction. The only way for Baltimore to achieve a higher FCR rate is to implement a data-driven maintenance work order distribution of 40% planned, 40% predictive and 20% reactive.
- The County's field operations are predominantly sewer related, which has fewer situations requiring reactive work, except for SSOs.
- When City crews work in the County, they do not have access to sewer GIS or information regarding sewer CIP work in the area. As noted elsewhere, this is a City IT problem and not because the County has not provided the information.
- The City has separate water and sewer field operations. Some systems cross-train their field operators, taking advantage of the seasonal differences in demand. There are more water main breaks in the winter and more sewer issues in hot months. The County reports that it has assisted the City during winter water main break emergencies.
- Winter problems can affect City crews working in County when County trucks are tied up in snow emergencies.
- The City does not report 311 complaint status to the County; however, the City reports work being performed in the County.
- County residents cannot create a service request online.
- When the County does CIP work, it can cause customers to lose service, but the complaint goes to the City. When customers call to check on the complaint, the City could provide an answer if the County had reported status to the City.
- Communication is poor at upper levels. Although meetings are held with regarding consent decree issues, there appears to be little communication regarding customer complaints.
- There are poor information flows. The chief method by which the County can determine progress regarding main breaks (the Water Main report) is not always current.

- Although the City and County data systems collect a great deal of data, the data collected is not focused on performance measures considered important by other utilities. As a result, the data streams inform what is happening but do not allow for performance-based management. Also telling is that neither the City nor the County has identified utility peers so that they can compare themselves to other utilities.

Opportunities for Enhanced Coordination

The current field operations process is inefficient, duplicative and customer unfriendly. Some opportunities for enhanced coordination include:

- As many relevant systems as possible should be linked. The City should be able to access County sewer GIS and County sewer CIP work.
- The number of phone numbers for complaints should be reduced. Phone numbers (such as the City operator) which will always be transferred to another number should be avoided.
- The Water Main report should be internet accessible by the County. Some last-minute changes are inevitable as long as the City remains in a reactive mode, but direct accessibility should minimize problems.
- Although the City and County investigators are looking for slightly different things, if the City utilized the County investigator's report, it could facilitate triage decisions (and help with the high rate of reactive work).
- The County does not have update access in Cityworks, so it depends on e-mails that may or may not be logged in a timely manner.
- Customer satisfaction surveys could identify problems that the customers have with field crews and what they want.
- The City should make every effort to reduce the level of reactive work.
- Regular communications should be established regarding customer complaints at the Bureau head level.
- County resident access to City 311 should be improved (this may have been done subsequent to the submission of this report).
- The use of Citysource for County web complaints should be expanded.

APPENDIX A
SUMMARY OF RELEVANT MARYLAND STATUTES

Laws of the State of Maryland of 1922 ("Acts of 1922")

Chapter 289

Codified in the Code of the Public Local Laws of Maryland (1930), Article 3, §§ 353-361

Purpose

An Act relating and requiring the sale and distribution of water by the Mayor and City Council of Baltimore to the County Commissioners of Baltimore County for the use of said county and the inhabitants thereof; and providing for the determination of the sales price of such water by the Public Service Commission of Maryland, subject to certain conditions.

Rate Provision

"[Baltimore County] shall pay the [Baltimore City] the actual cost of delivering said water at the points of connection and meter, with five per cent, added, and the actual cost of purifying said water, with five per cent, added, the cost of delivering and of purification to be determined by the Public Service Commission of Maryland"

Dispute Provision

"[T]he cost of delivering and of purification to be determined by the Public Service Commission of Maryland and to be subject to review and revision by the said Public Service Commission once only in every five years[.]"

Relevant Sections

Section 2, Chapter 289, of the Acts of 1922 (Article 3, § 354)

- "[E]ach and every connection of the water mains installed by said County Commissioners with said water mains of the Mayor and City Council of Baltimore shall be at the expense of said County Commissioners and under the supervision of the Water Engineer of Baltimore City or such other person or persons as the Water Engineer of Baltimore City, the Water Board of said city may appoint or such other body or officials as may for the time being have charge of the water system of said city, and said County Commissioners to bear the expense of said supervision. Every connection shall include a meter of a make and design approved by the Water Engineer of said city, to the end that all water flowing into each and every water system constructed by said County Commissioners may be measured, and said County Commissioners shall pay the said Mayor and City Council the actual cost of delivering said water at the points of connection and meter, with five per cent, added, and the actual cost of purifying said water, with five per cent, added, the cost of delivering and of purification to be determined by the Public Service Commission of Maryland and to be subject to review and revision by the said Public Service Commission once only in every five years on application of the County Commissioners of Baltimore County or the Mayor and City Council of Baltimore. In determining cost of delivering and of purification, the value or cost of impounding water at any source of supply and the value of cost of pipe lines and filtration plants shall be disregarded, it being the intention hereof that the sales price of water by the Mayor and City Council of Baltimore to the County Commissioners of Baltimore County through the connections and meters aforesaid shall be the cost of pumping the water to the points of connection and meter, and the cost of purifying such water,

and in addition, a sum equal to five per centum of said cost of pumping and purification, without any allowance for interest on investment or for amortization."

Section 6, Chapter 289, of the Acts of 1922 (Article 3, § 358)

- "[T]he distribution to consumers of water obtained under this Act shall be by meters, and the rates said County Commissioners shall charge for such water shall be determined by the Public Service Commission of Maryland and said Public Service Commission is hereby vested with as full and complete jurisdiction to determine such rates as if said County Commissioners of Baltimore County were a 'water company' as defined in Chapter 180 of the Acts of 1910."

Chapter 526

Codified in the Code of the Public Local Laws of Maryland (1930), Article 3, §§ 348-352

Purpose

An act to authorize the County Commissioners of Baltimore County to establish, construct, acquire and maintain and extend water systems in said county, conferring upon said County Commissioners all needful powers in respect thereto, including the power to raise the necessary funds therefor by taxation or assessments or borrowing upon the faith and credit of the county.

Relevant Section

Section 1, Chapter 526, of the Acts of 1922 (Article 3, § 348)

- "[T]he County Commissioners of Baltimore County shall be charged with the duty of constructing and establishing public county water systems in Baltimore County[.]"

Key Takeaways

- Chapters 289 and 526 of the Acts of 1922 were repealed by the Acts of 1945.

Two years later, the General Assembly passed the Acts of 1924, which created the Metropolitan District in Baltimore County. However, the operating control was in the hands of Baltimore City, who had the authority to establish water service rates for all consumers on such water lines. How these rates were decided was not specified.

The failure of that legislation and subsequent legislation to provide a roadmap for how rates and costs are to be determined has been a problem which the City and County attempted to remedy, at least for costs, by entering into the September 20, 1972 Agreement, discussed below in Section 5 of this evaluation. The 1972 Agreement has helped but has not entirely resolved the issue for reasons discussed below.

Laws of the State of Maryland of 1924 ("Acts of 1924")

Codified in the Code of the Public Local Laws of Maryland (1930), Article 3, §§ 327-346

Chapter 539 ("Metropolitan District Act")

Purpose

An Act to create a Metropolitan District in Baltimore County contiguous to Baltimore City; to provide for the construction, maintenance, operation, purchase or condemnation of water supply, sewerage and stormwater drainage systems; to provide for the issuance of bonds for the purpose of such construction, and the levy of taxes, assessments and benefits, water and sewer charges and rates for the payment of said bonds; and the operation, maintenance, regulation and control of said systems and granting certain powers and imposing duties on Baltimore City in connection therewith; and granting certain powers to Anne Arundel County in connection therewith; and granting certain duties on the Public Service

Commission of Maryland in connection therewith; to provide that the County Commissioners of Baltimore County shall sit on Monday of each week, and on such other days as may be necessary to carry out the provisions of this Act, to provide compensation to them for the performance of the duties imposed by this Act and for other purposes.

The Acts of 1924 did not repeal the Acts of 1922, Chapters 289 or 526, as seen above. Therefore, the provision regarding Baltimore County paying the cost of delivering and purifying water, plus 5%, was still in effect at this time.

Rate Provisions

"[T]he City of Baltimore . . . shall establish water service rates for all consumers on such water lines, who shall bill and collect such water rates . . . . All the water service rates established . . . shall be first approved by the Public Service Commission of Maryland . . . before they may become effective under the requirements of this Act."

"[W]ater supply systems [not constructed and operated by the City of Baltimore] shall be established by the Commissioners [of Baltimore County]."

"Such extensions [of water supply lines for and in the Metropolitan District] shall be made at cost, and including a proper charge for overhead[.]"

Dispute Provisions

"All the water service rates established as above shall be first approved by the Public Service Commission of Maryland, subject to the same right of appeal to the courts as is provided by law in the case of rates for public service corporations fixed by the Public Service Commission[.]"

Relevant Sections:

Section 1, Chapter 539, of the Acts of 1924 (Article 3, § 327)

- "[A]ll that part of Baltimore County described as follows: . . . is hereby designated and constituted for the purposes hereinafter set forth, to be the "Baltimore County Metropolitan District."
- "[F]or the purpose of carrying out the provisions of this Act, said District shall be under the jurisdiction of the County Commissioners of Baltimore County [("Commissioners").]"

Section 5, Chapter 539, of the Acts of 1924 (Article 3, § 331)

- "Such extensions [of water supply lines for and in the Metropolitan District] shall be made at cost, and including a proper charge for overhead."
- "The Public Service Commission of Maryland is hereby authorized and directed to review, upon application by the Commissioners, the cost of making such extensions, and the findings of the Public Service Commission shall be final except that there may be an appeal to the courts from such findings as is provide by law in the case of other determinations by the Commission."
- "The Commissioners are hereby empowered, authorized and directed to raise funds, as hereinafter provided, for the expenditures here above authorized and directed, and to pay to the City of Baltimore out of such funds from time to time such sum or sums either in advance or as such work is done as may be necessary to cover the cost of said work."
- "The proper authorities of Baltimore City are hereby empowered, authorized and directed to make installations of water supply service pipes to be connected to water mains whenever and wherever requested in writing by any individual, firm or corporation owning property within the Metropolitan District, provided such individual, firm or corporation shall, before said work shall be begun, deposit with the City of Baltimore a sufficient sum of money to cover the cost of such installations."

- "In like manner in case of disagreement between the City of Baltimore and any individual, firm or corporation as to the cost of any such service pipe made by said city for such individual, firm or corporation, the Public Service Commission of Maryland shall review said cost upon application, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the courts for such findings as is provided by law in case of other determinations by the Public Service Commission."

Section 6, Chapter 539, of the Acts of 1924 (Article 3, § 332)

- "[A]s soon as water extensions have been constructed by the City of Baltimore in the Metropolitan District, the operating control shall be in the hands of the proper authorities of the City of Baltimore, who shall establish water service rates for all consumers on such water lines, who shall bill and collect such water rates and shall maintain the water distribution system in as good a condition, and the water service in as efficient a manner as the remainder of the water system owned and operated by the City of Baltimore."
- "All the water service rates established as above shall be first approved by the Public Service Commission of Maryland, subject to the same right of appeal to the courts as is provided by law in the case of rates for public service corporations fixed by the Public Service Commission, before they may become effective under the requirements of this Act."

Section 7, Chapter 539, of the Acts of 1924 (Article 3, § 333)

- "[T]he Commissioners shall have full power and authority to enter into any agreement with the proper authorities of Baltimore City or Anne Arundel County, or both, and the proper authorities of Baltimore City and Anne Arundel County are hereby authorized to enter into any such agreement with Baltimore County or with each other for the disposal of sewage or drainage, by the connection of the sewers or drains of Baltimore County within the Metropolitan District with those of Baltimore City or Anne Arundel County, or vice versa, or with regard to any other matter necessary for the proper construction or operation of the water supply, sewerage or drainage systems under their control."
- "The costs or other fees for such connections shall be determined by agreement between the proper authorities of Baltimore City or Anne Arundel County and the Baltimore County Commissioners."

Section 8, Chapter 539, of the Acts of 1924 (Article 3, § 334)

- "[T]he Commissioners shall provide for each and, every property abutting upon a street or right-of-way in which, under this Act. a water main and/or sanitary sewer is laid, one or more water and/or sewer connections, as may be necessary, which shall be extended as required from the water main and/or sewer to the property line of the abutting lot, said connections to be constructed by and at the sole expense of the Commissioners, except that such water connections as are or can be made from water mains owned, operated or constructed by the City of Baltimore, as hereinbefore provided for in Section 5, shall be constructed by the City of Baltimore and the cost shall be met as already specified in Section 5."

Section 9, Chapter 539, of the Acts of 1924 (Article 3, § 335)

- "[F]or the purpose of paying the interest and providing the sinking fund for the bonds issued by the County Commissioners, as hereinafter provided for the water supply, sewerage and drainage systems to be constructed, purchased or established under this act, the Commissioners are hereby empowered and directed to establish a proper and reasonable charge for connection with said water supply, sewerage and drainage systems so to be constructed, purchased, or established as aforesaid, and to fix an annual assessment on all properties, improved and unimproved, binding upon a street, road, lane, alley or right-of way in which a water main, sewer or drain has been built. The said annual assessment shall be made upon the front foot basis, and the first payment shall be collectible during

the year that the construction is started on the water supply, sewerage, or drainage system, or in which the systems are purchased or acquired."

- "The Commissioners shall be empowered and directed to make a charge upon every building and place having a connection with the sewerage system under their control, said charge to be an annual sewerage service charge. All assessments and charges shall be uniform for each class of property throughout any sub-district, shall be subject to change annually and shall be collected by the Treasurer of Baltimore County excepting the water service rates, which shall be collected as already specified in Section 6. For those water supply systems not falling under the provisions of Sections 5 and 6, but constructed and operated by the Commissioners, water service rates shall be established by the Commissioners."

Key Takeaways

In 1924, the Metropolitan District was created and the provisions to supply water to it. The Act gave the power of establishing rates to Baltimore City, but the rates had to be approved by the Public Service Commission. At the same time, however, the Acts of 1922, Section 289, was still in effect, which had a different rate provision (cost plus 5%) to the County.

After the Acts of 1924, twenty years later, the General Assembly passed the Acts of 1945 to clarify the obligation of Baltimore City to Baltimore County. In doing so, the Acts of 1945 repealed the Acts of 1922 and amended and clarified the Acts of 1924, particularly concerning water service rates. The Acts of 1945 are still in effect to this day, and the Baltimore County Code has adopted the Acts of 1945 verbatim. In fact, the Acts of 1945 were discussed by the Court of Appeals of Maryland in its decision in 1991 regarding the arbitration decision between Baltimore City and Baltimore County, as will be discussed below.

Laws of the State of Maryland of 1945 ("Acts of 1945")

Purpose

To consolidate and to clarify Sections 332, 353 and 357 of Article 3 to clearly provide for the obligation of Baltimore City to furnish water in Baltimore County; to provide for procedure for establishing water service rates to be charged by Baltimore City to consumers in Baltimore County to the Metropolitan District at cost entirely without profit or loss and to establish the procedure for determining said cost.

Repealed and reenacted, with amendments, Sections 329, 330, 331, 332, 334, 335 of Article 3 of the Code of Public Local Laws of Maryland (1930) (i.e., Sections 3-6, 8-9, Chapter 539, of the Acts of 1924). Sections 5-6 and 8-9 were discussed above. Most importantly, Section 6 discussed how Baltimore City would establish water service rates for all consumers in the Metropolitan District and the Public Service Commission of Maryland had to approve.

Repealed Sections 348, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361 of Article 3 of the Code of Public Local Laws of Maryland (1930) (i.e., Sections 1-9 of Chapter 289 and Sections 1, 3-5 of Chapter 526 of the Acts of 1922). Sections 2 and 6 of Chapter 289 and Section 1 were discussed above. Most importantly, Section 2 of Chapter 289 included the provision on Baltimore County paying the cost of delivering and purifying water, plus 5%.

Rate Provisions

Section 332(b)

- "The rates to be charged by Baltimore City for furnishing water to consumers in Baltimore County shall be established by agreement between the City of Baltimore and the Commissioners, subject to approval by the Public Service Commission of Maryland. In the case of disagreement as to the rates

to be fixed, the Public Service Commission of Maryland, shall, upon the application of the Commissioners, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the Courts by either party, as is provided by law in the case of rates for Public Service Corporations fixed by the Public Service Commission. The rates, however, established, shall be subject to revision from time to time by agreement of the City of Baltimore and the Commissioners, subject to the approval of the Public Service Commission."

Section 332(c)

- "[Baltimore City] shall furnish water to the Metropolitan District of Baltimore County at cost and entirely without profit or loss. The Commissioners and the [Baltimore City] shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the Metropolitan District of Baltimore County."

Section 332(d)

- "[Baltimore City] shall maintain proper records to adequately and correctly reflect the amount of all income received from furnishing water service to consumers in Baltimore County; and annually shall render a statement to [Baltimore County] showing the total revenues received from Baltimore County water consumers . . . and the actual cost of furnishing such water[.] The excess of the income over actual cost shall be transmitted by [Baltimore City] with the statement to [Baltimore County.]" Likewise, if the costs are greater than the revenues, then "the deficit shall be deductible from future payments accruing to [Baltimore County.]"

Dispute Provisions

Section 332(b): Rate Disputes

- "[T]he Public Service Commission of Maryland shall, upon the application of the Commissioners, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the Courts by either party, as is provided by law in the case of rates for Public Service Corporations fixed by the Public Service Commission. . . . In case of disagreement as to a rate revision, either the City or the Commissioners may institute proceedings before the Public Service Commission for a review of the existing rates, with the subsequent right of appeal to the Courts as herein provided"

Section 332(c): Cost Disputes

- "If no agreement [as to the cost of Baltimore City furnishing water service to consumers in Baltimore County] is reached, then cost shall be determined by arbitration. . . . Cost, however, determined, shall be subject to revision from time to time by agreement of the respective authorities, or by arbitration on the demand of either of them."

Relevant Section

Section 332

- (a) "The operating control of water extensions in the Metropolitan District shall be in the hands of the Mayor and City Council of Baltimore who shall bill and collect the water rates established as hereinafter provided, and shall maintain the water distribution system in as good a condition, and the water service in as efficient a manner as the remainder of the water system owned and operated by the City of Baltimore so that there shall be at all times an adequate flow of water fit for human consumption, none the less pure than the water furnished by the Mayor and City Council of Baltimore to the inhabitants of Baltimore City, and sufficient to supply to the inhabitants of Baltimore County,

water for all public, private, domestic, manufacturing or other needs which the water mains were designed or intended to supply."

- (b) "The rates to be charged by Baltimore City for furnishing water to consumers in Baltimore County shall be established by agreement between the City of Baltimore and the Commissioners, subject to approval by the Public Service Commission of Maryland. In case of disagreement as to the rates to be fixed, the Public Service Commission of Maryland, shall, upon the application of the Commissioners, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the Courts by either party, as is provided by law in the case of rates for Public Service Corporations fixed by the Public Service Commission. The rates, however, established, shall be subject to revision from time to time by agreement of the City of Baltimore and the Commissioners, subject to the approval of the Public Service Commission. In case of disagreement as to a rate revision, either the City or the Commissioners may institute proceedings before the Public Service Commission for a review of the existing rates, with the subsequent right of appeal to the Courts as herein provided."
- (c) "The Mayor and City Council of Baltimore shall furnish water to the Metropolitan District of Baltimore County at cost and entirely without profit or loss. The Commissioners and the Mayor and City Council of Baltimore shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the Metropolitan District of Baltimore County. If no agreement is reached, then cost shall be determined by arbitration in the manner herein provided in Section 329. Cost, however, determined, shall be subject to revision from time to time by agreement of the respective authorities, or by arbitration on the demand of either of them."

Key Takeaways

The Acts of 1945 are still in effect, and therefore the most important provisions which govern the relationship between Baltimore City and Baltimore County. In fact, Section 332 of the Acts of 1945 were adopted and included verbatim in the Baltimore County Code, Article 20.

Although the Acts of 1945 were important for requiring that the rates to be charged by Baltimore City for furnishing water to consumers in Baltimore County to be set by agreement between both parties, the Acts of 1945 were silent over the method for calculating the cost. In 1972, the parties came to an agreement on the method of determining the City's costs of supplying water to consumers in the Metropolitan District. Shortly after execution of the 1972 Agreement, Baltimore City expressed dissatisfaction with the terms, which are shown below. Therefore, in 1991, these issues had to be resolved by an Arbitration Board, and subsequent appeal to the Court of Appeals of Maryland, as discussed below. The 1972 Agreement provides for a 6% upward adjustment on the determination of the City's costs. It is not clear how the City and County have reconciled that adjustment with the statutory requirement that the water shall be provided at cost and entirely without profit or loss. As discussed below, It may well be that the City and County consider the 6% adjustment to be a recovery mechanism for recovering costs not covered by cost line items used in the calculation.

As indicated above, Section 332(b) deals with the rates charged by the City to consumers in Baltimore County. It sets forth the Public Service Commission as the proper forum to approve those rates agreed upon by the City and County. If the County disagrees with the rates proposed by the City and files an application seeking review by the Public Service Commission, then the Public Service Commission will determine the rates. On the other hand, Section 332(c) deals with the determination of the cost to the City of furnishing water to consumers in the Metropolitan District of the County. If the City and County cannot come to an agreement as to cost, then that dispute goes to arbitration, not the Public Service Commission, for determination. It would also appear to be logical that the cost to the City of furnishing

water would have to be determined before the reasonableness of the rates charged by the City could be determined.

NewGen was advised in interviews of City and County representatives that the City and County have never sought the approval of the Public Service Commission, under Section 332(b), for the rates charged by the City to customers in Baltimore County. As discussed above, the City and County interpret applicable law to require the approval of the Public Service Commission only when there is a disagreement between them as to the setting of rates.

APPENDIX B
LEGAL ANALYSIS OF 1991 ARBITRATION DECISION

Arbitration Decision between Baltimore City and Baltimore County, Dated August 22, 1991, and Subsequent Court of Appeals Decision, Dated March 25, 1993

Background

Pursuant to the Acts of 1945, Baltimore City and Baltimore County had to come to an agreement on the costs and rates for furnishing water to the consumers in the Metropolitan District of Baltimore County. The City and County had agreed informally on the method for determining the cost, modifying the determination from time to time, and then memorialized their understandings in a formal agreement in 1972, where a debt service method was employed.

As stated above, the Acts of 1945 were silent over the method for calculating the cost. However, the Acts of 1945 were not silent on the dispute mechanism the cost to Baltimore City of furnishing water to consumers in the Metropolitan District of Baltimore County under Section 332(c): if no agreement is reached on the cost to Baltimore City for furnishing water, then cost would be determined by arbitration. Shortly after execution of the 1972 Agreement, the City expressed dissatisfaction with its terms. Therefore, this arbitration arose out of a dispute between Baltimore City and Baltimore County over the method for calculating the cost to the City of supplying water to consumers in Baltimore County.

On August 22, 1991, the issues were resolved by an arbitration board:

The arbitrators unanimously agreed that the utility basis was the appropriate method, under the Metropolitan District Act (Acts of 1945), for determining the cost to the City for furnishing water to consumers in the Metropolitan District of the County. Note that the 1972 Agreement had employed a debt service method.

A new method for determining Baltimore City's costs should be employed retroactively. Therefore, the arbitrators directed that the parties compute the additional cost due to the City under the new method from July 1, 1983 through June 30, 1990. Then, they directed that the County pay that amount to the City together with interest at 6%.

The arbitrators directed, in Conclusion of Law No. 16 of the decision that "Cost, as set forth in the Metropolitan District Act, henceforth shall be defined by the utility basis methodology (excluding return on equity) and functional cost allocation, Baltimore City and the Metropolitan District of Baltimore County immediately shall revise the 1972 Agreement to so provide." The County and City have not revised the 1972 Agreement. This remains an outstanding binding obligation that needs to be addressed as directed in the 1991 arbitration decision.

The County moved to vacate the retroactive portion of the award, which the Court of Appeals of Maryland eventually denied and then confirmed the arbitration award in its entirety.

The Court of Appeals of Maryland discussed the history of the laws that governed the relationship between the parties, including the Acts of 1945 and the 1972 Agreement in its opinion.

Rate Provisions

While the arbitrators unanimously found that the utility basis was the appropriate method, under the Metropolitan District Act, for determining the cost to the City of furnishing water to consumers in the

Metropolitan District of the County, how the utility basis was to be applied was not unanimous. A majority of the arbitrators ruled, that "the utility basis methodology is a reasonable method of determining the cost of providing water service to the Metropolitan District of Baltimore County, but must exclude return on equity capital as 'profit'". (Conclusion of Law No. 12).

The arbitrators also determined that "depreciation" is a proper expense of "cost" under the utility basis for determining costs, and that the Act's use of "cost" allows depreciation to be taken in that determination.

The arbitrators then directed that "cost" as set forth in the Act, henceforth "…shall be defined by the utility basis methodology (excluding return on equity) and functional cost allocation." The City and County were also directed to revise the 1972 Agreement to so provide. (Conclusion of Law No. 12).

July 1, 1983 was the effective date for implementation of that methodology.

Key Takeaways

Following the 1972 Agreement, the 1991 Arbitration found that the utility basis (excluding return on equity) was the appropriate method, under the Metropolitan District Act, for determining the cost to the City of furnishing water to consumers in the Metropolitan District of the County. This decision was affirmed by the Court of Appeals of Maryland in 1993 (329 Md. 692 (1993).

As will be shown below, the Baltimore County Code adopted the Acts of 1945, which are silent on the appropriate method to calculate costs. Therefore, following the arbitration, the utility basis (excluding return on equity) must be used.

APPENDIX C
SUMMARY OF LOCAL LAWS

Baltimore County Code

Purpose

Public local laws are the laws that are passed by the Maryland General Assembly that only apply to specific cities or counties. These laws are incorporated into the County or City's code.

The Baltimore County Code includes the 2015 Baltimore County Code of Public Local Laws. As early as 1948, the Code of Public Local Laws for Baltimore County contained the Acts of 1945.

Subsequently, in 1956, Baltimore County adopted a Home Rule Charter.

The laws discussed below are included in the 2015 edition of the Baltimore County Code.

Rate Provisions

Section 20-1-115 (same as Acts of 1945, Section 332(b))

- "The rates charged by Baltimore City to furnishing water to consumers in the county shall be established by agreement between the City of Baltimore and the [C]ounty, subject to approval by the state Public Service Commission. . . . The rates, however established, shall be subject to revision from time to time by agreement of the City of Baltimore and the [C]ounty, subject to the approval of the Public Service Commission."

Section 20-1-116 (same as Acts of 1945, Section 332(c))

- "The Mayor and City Council of Baltimore shall furnish water to the [M]etropolitan [D]istrict of the [C]ounty at cost and entirely without profit or loss. The [C]ounty and the Mayor and City Council of Baltimore shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the [M]etropolitan [D]istrict of the county."

Dispute Provisions

Section 20-1-115 (same as Acts of 1945, Section 332(b))

- "The rates to be charged by Baltimore City for furnishing water to consumers in the county shall be established by agreement between the City of Baltimore and the county, subject to approval by the state Public Service Commission. In case of disagreement as to the rates to be fixed, the state Public Service Commission shall, upon the application of the county, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the courts by either party, as is provided by law in the case of rates for public service corporations fixed by the Public Service Commission."

Section 20-1-115 (same as Acts of 1945, Section 332(b))

- "The rates, however established, shall be subject to revision from time to time by agreement of the City of Baltimore and the county, subject to the approval of the Public Service Commission. In case of disagreement as to a rate revision, either the City of Baltimore or the county may institute proceedings before the Public Service Commission for a review of the existing rates, with the subsequent right of appeal to the courts as herein provided."

Section 20-1-116 (same as Acts of 1945, Section 332(c))

- "The Mayor and City Council of Baltimore shall furnish water to the metropolitan district of the county at cost and entirely without profit or loss. The county and the Mayor and City Council of Baltimore shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the metropolitan district of the county. If no agreement is reached, then cost shall be determined by arbitration in the manner provided in § 20-1-108 of this title."

Section 20-1-116 (same as Acts of 1945, Section 332(c))

- "Cost, however determined, shall be subject to revision from time to time by agreement of the respective authorities or by arbitration on the demand of either of them."

Relevant Sections

Section 20-1-108 – Same – Arbitration with Baltimore City (formerly, 1988 Code, § 35-132)

- "If, in the future, the county should desire to acquire water distribution mains and their appurtenances owned by Baltimore City and serving consumers in the metropolitan district exclusively or, if the Mayor and City Council of Baltimore should seek to acquire additional rights for the construction of sewer or water facilities in any manner affecting the county, the county and the Mayor and City Council of Baltimore, in either event, shall negotiate and if unable to agree shall submit the matter to arbitration in the following manner:
- In any arbitration proceeding provided for in the preceding paragraph, the county shall appoint one (1) arbitrator and the Mayor and City Council of Baltimore shall appoint one (1) arbitrator. The two (2) arbitrators so appointed shall select a third, who shall be chairman of the Board of Arbitration. If the two (2) arbitrators are unable to agree upon the third arbitrator, the chief judge of the Court of Appeals shall be requested to designate such third arbitrator, and the written decision of the majority of the Board of Arbitration shall be final and binding upon both parties."

Section 202-1-113 – Control of Water Extensions; Duty of City to Supply Water (formerly, 1988 Code, § 35-138)

- "The operating control of water extensions in the metropolitan district shall be in the hands of the Mayor and City Council of Baltimore who shall bill and collect the water rates established as provided in § 20-1-115 of this title and shall maintain the water distribution system in as good a condition, and the water service in as efficient a manner as the remainder of the water system owned and operated by the City of Baltimore so that there shall be at all times an adequate flow of water fit for human consumption, none the less pure than the water furnished by the Mayor and City Council of Baltimore to the inhabitants of Baltimore City, and sufficient to supply to the inhabitants of the county water for all public, private, domestic, manufacturing, or other needs which the water mains were designed or intended to supply."

Section 20-1-115 – Establishment of Water Rates (formerly, 1988 Code, § 35-140)

- "The rates to be charged by Baltimore City for furnishing water to consumers in the county shall be established by agreement between the City of Baltimore and the county, subject to approval by the state Public Service Commission. In case of disagreement as to the rates to be fixed, the state Public Service Commission shall, upon the application of the county, review the rates proposed by the City of Baltimore, and the findings of the Public Service Commission shall be final, except that there may be an appeal to the courts by either party, as is provided by law in the case of rates for public service corporations fixed by the Public Service Commission. The rates, however established, shall be subject to revision from time to time by agreement of the City of Baltimore and the county, subject to the approval of the Public Service Commission. In case of disagreement as to a rate revision, either the

City of Baltimore or the county may institute proceedings before the Public Service Commission for a review of the existing rates, with the subsequent right of appeal to the courts as herein provided."

Section 20-1-116 – Water Service to be Furnished to District at Cost; Determination of Water Service Cost (formerly 1988 Code, § 35-141)

- "The Mayor and City Council of Baltimore shall furnish water to the metropolitan district of the county at cost and entirely without profit or loss. The county and the Mayor and City Council of Baltimore shall, from time to time, determine by agreement, if possible, the cost to Baltimore City of furnishing water to consumers in the metropolitan district of the county. If no agreement is reached, then cost shall be determined by arbitration in the manner provided in § 20-1-108 of this title. Cost, however determined, shall be subject to revision from time to time by agreement of the respective authorities or by arbitration on the demand of either of them. The Mayor and City Council of Baltimore shall maintain proper records and books of account to adequately and correctly reflect the amount of all income received from furnishing water service to consumers in the county and annually shall render a statement to the county showing the total revenues received from the county water consumers during the period covered by the statement and the actual cost of furnishing such water, determined as hereinbefore provided. The excess of the income over actual cost shall be transmitted by the Mayor and City Council of Baltimore with the statement to the county, to be expended by them in furtherance of the uses and purposes authorized by the Metropolitan District Act. If in any year the revenues mentioned above should be less than the cost, the deficit shall be deductible from future payments accruing to the county and shall be taken into consideration in any revision of consumer rates. The account books and accounts relating to consumers of water in the county shall be subject to audit by agents of the county upon request of the county."

Important Note

The Maryland Public Utilities Code has certain regulations for rate-setting by the Public Service Commission on interjurisdictional water. However, pursuant to Maryland Public Utilities Code Section 4-305, it does not apply to Sections 35-138, 35-140, 35-141 and 35-145 of the Code of Public Local Laws of Baltimore County (1988). Baltimore County has since rearranged its Code. Thus, it does not affect Sections 20-1-113, 20-1-115, 20-1-116 above.

Key Takeaways

The Baltimore County Code of 2015 has adopted, verbatim, the Acts of 1945, Section 332.

Baltimore City Code of Public Local Laws

Baltimore City is considered a county for most purposes under state law. Baltimore City is a charter form of government and achieved Home Rule status in 1918.

Public Local Laws are passed by the Maryland General Assembly that only apply to specific cities or counties. Baltimore City and Baltimore County do not pass and cannot change those laws.

The Baltimore City Code of Public Local Laws has adopted language from the Acts of 1922, Section 289, which includes the provision allowing the City to add 5% to the cost of delivering and purifying water. The Acts of 1922 were repealed by the Acts of 1945.

There is no conflict between the Acts of 1945 and local City ordinances. The City established its water and sewer utilities as enterprise funds in 1979, and subsequently included a stormwater fund. Article VI, §18 of the Baltimore City Charter provides, "Each of the utilities shall be financially self-sustaining and shall be operated without profit or loss to other funds or programs of the City.

Baltimore City Charter Amendment—Inalienability of Sewer and Water-Supply Systems—(Nov. 6, 2018)

Background

Prior to November 6, 2018, Article VIII of the Baltimore City Charter provided that the title to certain City property was inalienable. The City's sewer and water supply systems were not included among the certain inalienable City property. Because there were efforts by one or more private companies to acquire the City's water supply system and sewer system, or lease them on a long-term basis, public opposition arose to the sale and/or lease of those systems. As a result, Council Bill 18-0271 was introduced, proposing to amend Section 1 of Article VIII of the City Charter to include the City's sewer system and water supply system as inalienable. It also proposed excepting the City's sewer system and water supply system from public properties and places for which the City may grant specific franchises or rights relating to the operation or use thereof.

The Vote

City Council

The proposed City Charter Amendment was passed by City Council on August 6, 2018, approved by the Mayor on August 10, 2018, and submitted to the voters of Baltimore City for adoption or rejection.

Baltimore Voters

Baltimore voters made history on November 6, 2018, by voting in favor of passing the City Charter Amendment. Baltimore became the first major city in the country to amend its charter to prohibit the sale, lease and/or franchise of the City's water and sewer system.

Observation

Any future approach that the City may consider with respect to restructuring, ownership and/or operation of its water supply system and sewer system must be within the bounds of the City Charter Amendment. If not, another amendment to the City Charter would be required to accommodate that approach. There is a question as to whether the City Charter Amendment would prevent the City from forming a joint regional water and sewer authority with surrounding political subdivisions or from hiring a private management services entity to manage the City's water and/or wastewater systems.

APPENDIX D
BALTIMORE CITY/COUNTY WATER AND SEWER BUSINESS PROCESS QUESTIONNAIRE

Baltimore City and Baltimore County have initiated a comprehensive business process review of the water and wastewater systems that serve both jurisdictions. As part of this review, our consultant team has been collecting data and conducting interviews with key employees.

This questionnaire has been developed as a part of the review of the organizational structures within each jurisdiction. We need your input and assistance to provide insights about how the respective departments are organized to provide water and wastewater services to City and County customers. We have learned that some of the most valuable input comes directly from employees like you.

The information you provide will be compiled into summaries and NOT be attributed to any individual respondent, so feel free to provide us with your honest thoughts and candid suggestions.

Thank you in advance for your assistance.

General Info and Work Experience

Name: _____

Position/Title: _____

Bureau/Department/Office: _____

Total years of relevant experience (including outside of the City/County): _____

Name and position of your supervisor/manager: _____

Responsibilities and Work Relationships

7. How accurately does your position description describe your duties?

☐	☐	☐	☐	☐
very accurately	somewhat accurately	neutral/ no opinion	not very accurately	not at all accurately

If your position description does not accurately reflect your duties, please identify duties you perform that go beyond your position description: _____

_____

_____

_____

_____

8. To what extent do you agree with this statement: "My unit has up-to-date written procedures, policies and/or guidelines for the major activities that are being carried out by me and my staff"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

9. To what extent do you agree with this statement: "The Department's strategic goals, mission, objectives, and priorities been clearly communicated to me"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

10. How much direction and guidance do you receive from your supervisor?

☐	☐	☐	☐	☐
sufficient direction/ guidance	some direction/ guidance	neutral/ no opinion	not much direction/ guidance	no direction/ guidance

Additional comments: _____

_____

_____

_____

11. To what extent do you agree with this statement: "I have access to the data and information that is necessary to timely and effectively complete my work"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

If you disagree, what information/data do you require from others in your organization to timely and effectively complete your work? _____

_____

_____

_____

Organization

12. To what extent do you agree with this statement: "The current organizational structure promotes positive interactions and good communications"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

What elements of the present structure would you change (if any) and why? _____

_____

_____

_____

13. To what extent do you agree with this statement: "The leadership in my organization effectively communicates expectations, goals and priorities"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

14. To what extent do you agree with this statement: "My organization effectively anticipates and reacts to internal and external changes"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

15. To what extent do you agree with this statement: "Communication between my supervisor and me is timely and sound"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

16. To what extent do you agree with this statement: "We have the right balance of employees and contractors/consultants"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

Resources

1. To what extent do you agree with this statement: "Staffing in my unit is adequate"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

2. Has the staff in your organization increased or decreased in the last three (3) years? If increased or decreased, what do you think is the reason for the change, and has it negatively affected your unit?

_____

_____

_____

_____

3. How adequate is your organization's process to capture the knowledge of retiring or departing employees and prepare for their replacement?

☐	☐	☐	☐	☐
very adequate	somewhat adequate	neutral/ no opinion	not very adequate	not at all adequate

Additional comments: _____

_____

_____

_____

4. How would you rate the support you receive from Human Resources on hiring, employee discipline, employee retention and the application of HR policies?

☐	☐	☐	☐	☐
highly effective	somewhat effective	neutral/ no opinion	somewhat ineffective	highly ineffective

Additional comments: _____

_____

_____

_____

5. To what extent do you agree with this statement: "Sufficient and timely training has been provided to employees in my department to perform their job functions effectively"?

☐	☐	☐	☐	☐
strongly agree	somewhat agree	neutral/ no opinion	somewhat disagree	strongly disagree

Additional comments: _____

_____

_____

_____

6. How adequate are the information technology resources in your department to effectively perform its mission?

☐	☐	☐	☐	☐
very adequate	somewhat adequate	neutral/ no opinion	not very adequate	not at all adequate

Additional comments: _____

_____

_____

_____

Job Satisfaction, Performance and Morale

1. How satisfied are you with your job?

☐	☐	☐	☐	☐
very satisfied	somewhat satisfied	neutral/ no opinion	not very satisfied	not at all satisfied

What specific actions could be taken to raise your job satisfaction? _____

_____

_____

_____

2. Is employee performance evaluated on a regular basis? If so, please explain the frequency and your thoughts on the current value of the performance review process.

_____

_____

_____

_____

3. How well does the organization identify poor performers and work with them to improve their performance?

☐	☐	☐	☐	☐
very well	somewhat well	neutral/ no opinion	not very well	not well at all

Additional comments: _____

_____

_____

_____

4. How would you characterize the morale in your department?

☐	☐	☐	☐	☐
very good	good	neutral/ no opinion	poor	very poor

What actions could be taken to improve employee morale? Is management working to improve employee morale? _____

_____

_____

_____

Improvements and Final Recommendations

1. How do you think the efficiency and effectiveness of the organization's functions can be improved over time?

_____

_____

_____

_____

2. Of the range of improvements you may suggest to the project team, what one recommendation do you believe will make the greatest positive difference in creating the "Utility of the Future" and delivering service excellence to customers?

_____

_____

_____

_____

3. Is there anything else you would like to add or you would like the project team to know?

_____

_____

_____

_____

Thank you again for taking the time to fill out this questionnaire.

Your input is very important to us.

APPENDIX E
CONSTRUCTION BMP QUESTIONNAIRE

The following questionnaire has been adapted from the 2019 California Multi-Agency CIP Benchmarking Study. The California Multi-Agency CIP Benchmarking Study *(Study)* is a collaborative effort that involves the sharing of ideas and data between several of the largest cities in California. The report presents the findings of several key components of the study including performance benchmarking and best management practices (BMPs).

Performance benchmarking is conducted to establish relationships between project delivery costs and total construction cost (TCC). The *Study* examines how these relationships change over a five-year trailing period. This is a core concept of the Study that provides a meaningful benchmark by which participating agencies can assess their project delivery performance and identify potential reasons for differences between them and peers.

Best management practices are discussed between agencies and tracked to provide participating agencies a living archive of practices being implemented by peers, lessons learned through their implementation, and potential benefits to be derived if implemented.

The project data submitted by the agencies are compiled in a customized Microsoft Access® database. This database has served as a repository for the data collected since the inception of the *Study*. Each year, the project database is updated with the inclusion of project data submitted for that *Study* year and updated project data submitted for previous years. The updated 2019 database includes a total of 596 projects, 476 of which belong in the 80th percentile subset.

Instructions

Below you find a best management practice (BMP) and the benefits from using the BMP (Description). For each, indicate which of the following apply by filling in the circle:

- ○ Yes, we do this when appropriate
- ○ No, we do not do this by choice
- ○ We cannot do this because _____(provide reason)

BMP: Define capital projects well with respect to scope and budget including community and client approval at the end of the planning phase.

Description: Changes in project scope or budget increase both total construction cost and the cost of project delivery. The later these changes occur in the life of the project, the greater the increase. Reaching and documenting consensus with the community and the client will reduce changes after the project delivery process begins.

- ○ Yes, we do this when appropriate
- ○ No, we do not do this by choice
- ○ We cannot do this because _____(provide reason)

BMP: Complete Feasibility Studies on projects prior to defining budget and scope.

Description: Feasibility studies should be completed early in the process so that issues are identified and either resolved or accommodated within the final definition of scope, budget, and project delivery schedule. This will also reduce overall project delivery costs. Early feasibility studies are particularly important on complex projects and projects with a construction budget greater than $5 million.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Utilize a Board/Council project prioritization system.

Description: Departments responsible for project delivery have limited resources. A system will ensure that resources are directed to meet the community's most critical needs.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Resource load all CIP projects for design and construction.

Description: The resources required to deliver projects according to the master CIP schedule mandated by the Board/Council should become part of the CIP. This will facilitate defining performance measures and ensure that there is a common understanding of the resources required to deliver the CIP.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Include a Master Schedule in the CIP that identifies start and finish dates for projects.

Description: A master schedule can be used to define resource needs and performance measures.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Make an early determination on which environmental document is required and incorporate into the schedule.

Description: Completing the environmental assessment and permitting process influences project schedules and costs. Establish a checklist of potential environmental and permit requirements and examine each project scope against the list early in the planning process.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Show projects on a Geographical Information System.

Description: Entering and tracking planned projects into a GIS which is available to all private and public sector project planners will reduce the potential for conflicts and rework.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Provide a detailed clear, precise scope, schedule, and budget to designers prior to design start.

Description: Reliability, maintenance, operational requirements, and standard materials and equipment should be clearly defined in advance, approved by the user/ client, and included in the design professional's contract when a consultant is used.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Define requirements for reliability, maintenance, and operation prior to design initiation.

Description: Reliability, maintenance, operational requirements, and standard materials and equipment should be clearly defined in advance, approved by the user/client, and included in the design professional's contract when a consultant is used.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Adapt successful designs to project sites, whenever possible (e.g., pump stations, maintenance facilities, etc.).

Description: Successful designs of, maintenance facilities, pump stations, and many other projects should be re-used when possible. Site adaptations of successful designs may reduce design costs by half.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Train in-house staff to use Green Building Standards.

Descriptions: Communities have a stake in the environment as well as in the cost of operating and maintaining public facilities. Utilizing "Green Building Standards" allows facilities to be built and operated with renewable resources and other environmentally sound practices.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Limit Scope Changes to early stages of design.

Description: It is well known within the industry that the later a change occurs in the construction process, the more costly the change is.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Require scope changes during design to be accompanied by budget and schedule approvals.

Description: All scope changes after the initial definition within the design agreement will affect project delivery cost and therefore should be documented. Documentation should include an understanding and acceptance/approval by all stakeholders of the cost and time implications of any changes.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement a rotating Request for Quote process for contracting small projects to streamline the bidding and award process during construction. (Include criteria for exemptions from formal Council approval).

Description: Smaller projects cost more (as a percentage of construction cost) to deliver. One way of reducing the cost of project delivery on small projects is to shorten the bid and award process by setting a threshold amount under which the delivery team may solicit and receive quotes from qualified contractors and award contracts without getting Board/Council prior approval.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Establish criteria for obtaining independent cost estimates which take in consideration both project characteristics and volatility of the market.

Description: Having to re-design and re-bid a project on which bids come in over budget can significantly impact project delivery cost. Accurate estimates at the end of each design phase, performed by unbiased, independent, qualified professionals with an understanding of local market conditions will reduce the potential for receiving unexpected bids.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Establish criteria for responsible charge design approval such that it occurs at the lowest appropriate organizational level in order to expedite design completion.

Description: Many times, responsible charge design approval is set at an extremely high level. This can sometimes result in only one person with limited time who can approve all sheets in a design package. This leads to a bottleneck situation.

Yes, we do this when appropriate

- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Receive bids electronically.

Description: Electronic bidding programs have increased over the last several years. Receiving bids electronically provides a centralized location to store all bid related documents for public access along with ability to increase bidder participation.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Use of electronic signatures to do direct conversion from CAD to PDF.

Description: Currently wet signatures on all pages is standard practice. This causes scanned files to be very large electronic files. Use of electronic signatures in all but the cover page will reduce file size and allow for easier distribution.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Have awarding authority to approve plans, advertisement and award of contract in one board/ council action**.**

Description: Combine approval of plans, advertisement and award of contract by the awarding authority into a single action.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Lessen time period between design completion and issuance of notice to proceed. Examples include items such as:

- Pre-qualification of contractors
- Good Faith Effort submitted on-line
- Submittal incentives (i.e., award and material submittals allowed 30 day period; every day early is added to construction contract duration)
- Have ability to issue contracts within your department
- Electronic proposal documents provided 48 hours after bid opening; hard copy provided at bid time
- Contractor's self-certification

Description: Implementation of new practices such as using an electronic process or pre-qualification to reduce the overall timeframe from design completion to notice to proceed.

- o Yes, we do this when appropriate
- o No, we do not do this by choice
- o We cannot do this because _____(provide reason)

BMP: Develop and use a standardized Project Delivery Manual.

Description: Standardized procedures streamline project design, bidding, and construction processes. Standardized design management procedures will reduce scope creep and delays in construction document preparation. During construction, standard procedures will reduce response times on RFIs, and add overall clarity and efficiency to the construction management process. Having a standard manual will also reduce the time necessary for project documentation training.

- o Yes, we do this when appropriate
- o No, we do not do this by choice
- o We cannot do this because _____(provide reason)

BMP: Perform a formal Value Engineering *Study* for projects larger than $1 million.

Description: Value Engineering identifies life cycle costs of design elements included in a project and certain alternatives. While the cost of the value engineering process may initially add costs to project delivery, overall project costs will be reduced.

- o Yes, we do this when appropriate
- o No, we do not do this by choice
- o We cannot do this because _____(provide reason)

BMP: Use a formal Quality Management System.

Description: Quality management should include all activities from the preparation of design documents through the closeout of construction. (Constructability reviews, independent cost estimates, classification and auditing of change orders, etc.) The implementation and tracking of quality control should be formalized on a checklist to insure application.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Perform and use post-project reviews to identify lessons learned.

Description: Project Managers should develop formal post project reviews and identify lessons learned. These documents should be made available to PM's on projects of a similar scope and nature. This BMP will make future project management and delivery more efficient and cost effective.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Maintain and regularly update electronic standard contract specifications and related documents as well as technical/special provision.

Description: Standard contract specifications and technical special provisions need to be regularly maintained and updated in order to reduce the amount of time required to create contract bid documents. If a City implements new requirements, the standards should be modified for every project one time instead of each manager having to modify these documents of every project.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Delegate authority to the City Engineer/Public Works Director or other departments to approve change orders to the contingency amount.

Description: Change order work should be authorized as soon as is practically possible in order to avoid potential delays to critical work. Scheduling a significant change order for review and authorization by the Board may delay project progress, even though it may be within the contingency amount allowed in the project budget. Authorization of the City Engineer/ Public Works Director to approve changes within the contingency budgeted for changes will ensure that critical changes are acted on promptly and that delays are minimized.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Classify types of change orders.

Description: Classification of change orders into categories such as changed conditions, unforeseen conditions, owner requests, or design changes for owner use improves understanding of the project and lessons learned from the data may improve project delivery on similar projects.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Include a formal Dispute Resolution Procedure in all contract agreements.

Description: Construction is acknowledged as a dispute prone industry. As such, it makes sense to provide options in the contract documents to avoid litigation and to expedite disputes resolution using alternatives to litigation**.**

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Use a team building process for projects greater than $5 million.

Description: Partnering is a team-building process that has a proven record of improving working relationships and production and reducing claims and disputes on construction projects. It is one of several team-building processes that should be used in the interest of reducing conflict and facilitating project delivery.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Involve the Construction Management Team prior to completion of design.

Description: Experienced contractors and construction managers should be included in the design process to make designs more constructible and lower cost. Construction managers and contractors are frequently more experienced about the products and/ or equipment as well as construction methods that are readily available. Their contributions to selections and decisions during the design process will facilitate construction procurement, means and methods.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement Electronic Contract Payment Process.

Description: Many approvals are required to process contract payments. Using electronic procedures provides an avenue to expedite the necessary approvals.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Agency should file As-built drawings within 6 months of project completion.

Description: One of the last tasks for a project is the updating and filing of As-built drawings. Many times, this task is put off for other pressing matters. This BMP establishes a 6 month deadline.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Delegate authority below Council to make contract awards under $1 million.

Description: The time and costs of scheduling and presenting a Council or Board item can be saved and project starts can be expedited if awards on projects with budgets under $1 million can be awarded administratively.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Establish a pre-qualification process for contractors on large, complex projects.

Description: Prequalification helps screen contractors for prior performance on similar projects, safety and financial capability thus reducing risk and, ultimately, project delivery cost.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Make bid documents available online.

Description: Making bid documents available on line will reduce Agency printing costs. It may also increase bidder participation by making documents easily available to a larger pool of potential bidders and subcontractors.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Assign a client representative to every project.

Description: Client (end user) representation during the life of the project will expedite decisions on submittals, substitutions, and changes. Their involvement will also help determine intent and streamline the commissioning and occupancy process.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Create in-house project management team for small projects.

Description: It has been documented that the cost of project delivery of small projects is a higher percentage of the construction cost. Establishing a project management team that specializes in smaller projects may lead to economies such as grouping similar projects during permitting and bidding thus reducing project delivery cost.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Institutionalize Project Manager performance and accountability.

Description: : Recognize that professional project management requires specific education, training, and experience. Provide for PMI, CCM, or other formal training and certification and establish performance measures for project delivery personnel.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Provide formal training for Project Managers on a regular basis.

Description: Project Managers come to projects with varying degrees of skill and familiarity with Agency procedures. Orientation and training will improve their ability to deliver the project on the intended schedule. It is also important that updated training is available at least on an annual basis.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement verification procedures to ensure that PM training includes Agency policies, procedures, forms, and standards of practice (scheduling, budgeting, claims avoidance, risk analysis, etc.).

Description: The success of a project is influenced significantly by the education and skills of the project manager. Agencies should verify that PM's know and use the tools available within an Agency and that they are current with industry practices.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Adopt and use a Project Control System on all projects.

Description: A web-based project control system will improve collaboration and documentation during the design and construction process. Questions, answers, proposals, and decisions can be expedited using a collaborative system.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement a financial system that tracks expenditures by category to monitor project hard and soft costs during project delivery.

Description: It is recommended that a system that identifies actual expenditures against planned budgets be made available to project managers to be used as a performance measurement too.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement a Work Breakdown Structure (WBS) to measure progress on project deliverables.

Description: Getting accurate data on the cost of project delivery depends upon being able to capture and classify expenses to the phases of construction on each project. Ideally, costs would be identified by each of five project delivery phases and coded to particular milestones or deliverables.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Monitor "earned value" versus budgeted and actual expenditures during project delivery.

Description: Soft costs "burn rate" should be proportionate to percent complete during the design and construction phases. Using a program which measures and relates soft cost expenses to earned values permits better tracking and control during project delivery.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement an electronic progress payment/ schedule of values system to improve efficiency.

Description: Reduction in the length of time and inefficiencies in processing of progress payments using electronic means.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement a schedule tracking system that monitors the actual percent complete against the percent of time elapsed for each identified phase of the approved project schedule.

Description: Establishing a system where a project's schedule is broken into its phases. Actual percent complete is then measured against time elapsed in each phase throughout the development of the project. This system becomes a tool for management by project managers and supervisors.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Establish the use of dashboards as a quick way to check project delivery performance for both internal and external reporting that is easy to use, has appropriate level of transparency and is efficient.

Description: The dashboard concept is based on the ability to drill down to multiple levels of data so the user can get the level of detail desired. The level of detail to be provided in each dashboard is at the discretion of each Agency. The external dashboard increases public awareness of the project delivery performance and increases agency accountability. The internal dashboard provides a platform to measure, monitor, evaluate, and report performance to assist in establishing clear business rules and improve internal communication.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Bundle small projects whenever possible.

Description: Bundling small projects so that they are designed, bid, and constructed together will reduce project delivery cost proportionately.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Include a standard consultant contract in the RFQ/RFP with an indemnification clause.

Description: The negotiation of the design contract can be expedited if the consultant understands and agrees to the conditions of the contract at the time a proposal is submitted.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Delegate authority to the Public Works Director/ City Engineer to approve consultant contracts under $250,000 when a formal RFP selection process is used.

Description: Authorization for the Public Works Director/City Engineer to award consulting contracts ensures earlier start of design and construction management activities and will reduce consultant selection process costs.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement and use a consultant rating system that identifies quality of consultant performance.

Description: The performance of consultants should be tracked so that those who deliver quality services at reasonable costs can be adequately considered for future awards.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Implement as-needed, rotating, or on-call contracts for design and construction management work that allow work to be authorized on a task order basis to expedite the delivery of smaller projects.

Description: Establishing an on-call list of qualified consultants with expertise in a variety of design disciplines will expedite the start of the design process.

- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

BMP: Determine appropriate consultant costs for professional services agreements.

Description: Establish a documented agency methodology for analyzing acceptable consultant costs and billing rates for use in contract negotiations.

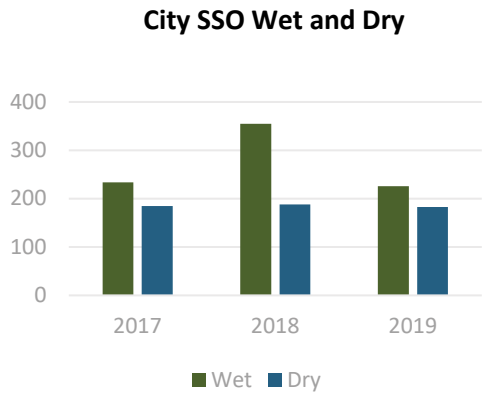
- Yes, we do this when appropriate
- No, we do not do this by choice
- We cannot do this because _____(provide reason)

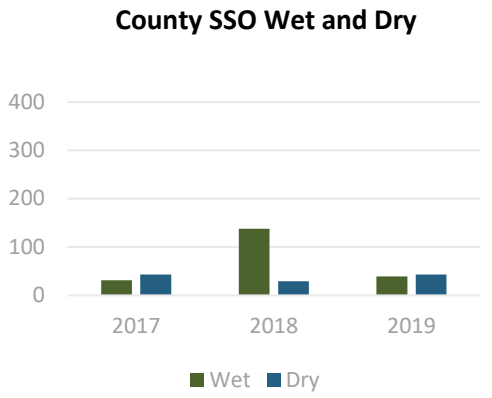
APPENDIX F
SSO PERFORMANCE

This supplement provides historical SSO performance for the City and County. The source of our data is MDE's SSO database, which has been reporting on SSO performance by jurisdiction since January 2005 and has been reporting on SSO types by weather since 2017.

SSOs by Weather 2017-2019

The following bar charts show wet and dry SSOs for 2017 to 2019:



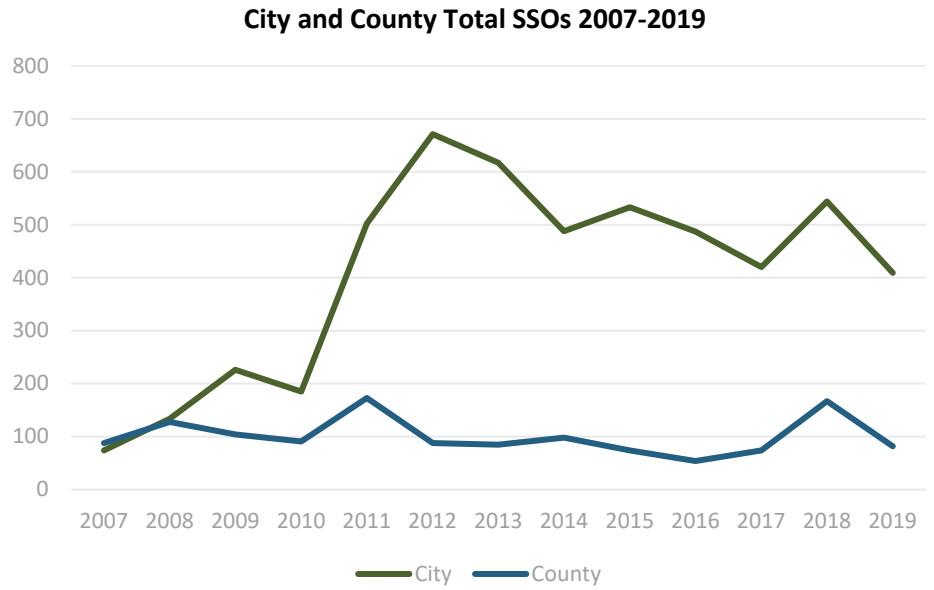


The County's 2019 dry SSO rate is better than the median for combined water and sewer utilities as reported by AWWA's benchmarking for 2019. The County was 1 SSO per 100 miles greater than the median (combined water and sewer utilities) for wet SSOs. With a few years of consent decree construction remaining, the County should be able to reach the median.

The City has more consent decree construction remaining.

Comparative SSO Performance 2007-2019

The following chart displays 12 years of reported SSOs:



There are a number of factors that make SSO reduction more difficult for the City. At one point early in the consent decree programs, the City and County coordinated their efforts. The separation in the two lines above appears to correspond to the point where the programs went in different directions. The City and County are now moving to a high level of communication and coordination, and it is reflected in recent performance improvements.

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