ARCADIS

Philadelphia Water Department

CONSULTING ENGINEER'S REPORT

For the Twenty-Sixth Supplemental Ordinance

FINAL

January 18, 2022

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1 INTRODUCTION

This Consulting Engineer's Report for the Twenty-Sixth Supplemental Ordinance is provided to summarize the findings and conclusions of the engineering review performed by Arcadis U.S., Inc. (Arcadis) for the water, wastewater, and stormwater systems (System) of the Philadelphia Water Department (Water Department). The Restated General Water and Wastewater Revenue Bond Ordinance of 1989 and the amendments and supplements thereto, including without limitation the First through the Twenty-Fifth Supplemental Ordinances (together the "General Ordinance"), require the preparation and submission of a Consulting Engineer's Report prior to the enactment of a Supplemental Ordinance authorizing the issuance of bonds under the General Ordinance. Arcadis has prepared this Report on behalf of the Water Department to satisfy this General Ordinance requirement. Capitalized terms used but not defined in this Report have the meanings set forth in the General Ordinance.

In preparation of this Report and the conclusions contained herein, Arcadis has relied on certain assumptions, information, and data (collectively, "information" for purposes herein) provided by the Water Department with respect to conditions that may exist or events that may occur in the future. Arcadis has not independently verified the accuracy of the information provided by the Water Department. While we believe such sources are reliable and the information obtained therefrom is appropriate for the analysis undertaken and the conclusions reached, as is often the case, there will likely be differences between actual and projected results. Accordingly, some of the estimates used in this Report may not be realized, and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the data and results projected in this Report and actual results achieved, and those differences may be material. To the extent that the information provided to Arcadis by the Water Department is not accurate, the conclusions and recommendations contained in this Report may vary and are subject to change. Any statements in this Report involving estimates or matters of opinion, whether specifically designated or not, are intended as such, and not as representation of fact. This Report summarizes the work completed up to the date of the issuance of the Report. Changed conditions occurring or becoming known after such date could affect the material presented to the extent of such changes. Arcadis has no responsibility for updating this Report for changes that occur after the date of this Report.

For a complete understanding of the analyses undertaken and the assumptions upon which the conclusions in this Report are based, this Report should be read in its entirety.

1.1 Scope

Consistent with the General Ordinance requirements, this Report presents the results of a financial projection for the period FY 2022 through FY 2028. The financial projection is based on a review of the Water Department's historical financial data and other information and is performed to provide an estimate of future financial operations for the Water Department. The Report also presents a review of the Water Department's organization and management; the System, including its general condition; adequacy of system capacity; general operation and maintenance (O&M) practices; and a review of the proposed Capital Improvement Program (CIP) of the Water Department. This Report does not include a review of any pending or threatened litigation against the Water Department. This Report is prepared in anticipation of the issuance of water and wastewater revenue bonds during FY 2023 and FY 2024.

The Arcadis team performed site visits and conducted visual inspections of major water and wastewater treatment facilities during the month of October 2021. Arcadis reviewed the current condition and operation and maintenance of the water and wastewater systems. General observations consisted of visual examinations of above ground, selected facilities which we believe are adequate for commenting on the overall condition of the facilities. We met or corresponded with key Water Department staff during October through December 2021 to discuss other facilities, regulatory compliance, staffing, and key initiatives of the Water Department. During the preparation of this Report, we also reviewed reports and information provided by the Water Department, as well as relevant, publicly available reports and information, to supplement our field observations and discussions with Water Department staff.

The general outline of the Report is as follows:

1. Projected Financial Requirements – This includes a projection of the Water Department's revenues and revenue requirements, including necessary revenue increases needed to meet O&M expenses, existing and projected debt service related to funding the Capital Improvement Program, debt coverage targets, and transfers to reserve funds to maintain target balances.
2. Water Department Organization – This includes an overview of the Water Department's organizational structure, key operating divisions, and initiatives.
3. Water and Wastewater Systems – This provides information related to the System, including an overview of assets, regulatory issues, operating units, and planning initiatives.
4. Capital Improvement Program – This provides an overview of the Water Department's FY 2023 through FY 2028 CIP.
5. Conclusions – This provides a summary of Arcadis' major conclusions and relevant assumptions and considerations.

1.2 Arcadis Qualifications

Arcadis is a leading global Design and Consultancy firm for natural and built assets. We apply deep market sector insights and collective design, consultancy, engineering, project and management services to work in partnership with our clients to deliver exceptional and sustainable outcomes throughout the lifecycle of their natural and built assets. Arcadis employs approximately 28,000 people and is active in over 70 countries. We employ specialists in every aspect of the water cycle from source of supply development to wastewater treatment to stormwater resiliency. Our technical experts are well-versed in U.S. water, wastewater, and stormwater regulations, as well as the design of water and wastewater systems. Our public sector clients range from small municipalities to large cities, state agencies and agencies of the U.S. government. Key water industry technical services include the following:

- Master planning for water and wastewater systems
- Design of water distribution and wastewater collection systems
- Design water and wastewater treatment facilities
- Operation and Maintenance assistance
- Distribution and water quality modeling
- Supervisory Control and Data Acquisition (SCADA) systems

- Asset Management

Members of Arcadis' Water Division participated in the development of this Report. This includes conducting interviews of key managers within the Water Department and performing site visits of key Water Department facilities. These Arcadis staff members are experienced engineers that know and understand the U.S. water industry and regulatory environment.

In addition to our strong engineering and technical expertise, Arcadis brings a wide range of business advisory experience to help utilities meet their financial and management challenges. The Business Advisory practice of Arcadis focuses on the management, financial, organizational and information technology needs of municipal water and wastewater utilities. The Projected Financial Requirements section of this Report has been prepared by members of Arcadis' Business Advisory practice. These professionals maintain significant experience with completing utility financial planning, cost of service, and rate assessments for water, wastewater, and stormwater utilities. Additionally, these professionals have participated in many similar bond engineer reports for utilities comparable to the Water Department.

2 PROJECTED FINANCIAL REQUIREMENTS

2.1 Overview

Arcadis performed a projection of the Water Department's revenue and revenue requirements for the period FY 2022 through FY 2028. The projection is performed to determine the adequacy of System revenues to meet projected revenue requirements, including O&M expenses, outstanding and projected debt service, cash funded capital, and reserve fund transfers. The projection is also performed to determine compliance with General Ordinance requirements, including the Rate Covenant. The General Ordinance Rate Covenant requires the City to charge and collect water and wastewater rents, rates, fees, and charges that yield Net Revenues which are equal to at least:

1. 1.20 times the Debt Service Requirements for such Fiscal Year (excluding Debt Service Requirements in respect of Subordinated Bonds); and
2. 1.00 times (A) the Debt Service Requirements for such Fiscal Year (including Debt Service Requirements in respect of Subordinated Bonds); (B) amounts required to be deposited into the Debt Reserve Account during such Fiscal Year; (C) the principal or redemption price of and interest on General Obligation Bonds payable during such Fiscal Year; (D) debt service requirements on Interim Debt payable during such Fiscal Year; and (E) the Capital Account Deposit Amount for such Fiscal Year (less any amounts transferred from the Residual Fund to the Capital Account during such Fiscal Year).

Net Revenues, for purposes of items 1 and 2 above, include any transfers made to or from the Rate Stabilization Fund by the Water Department.

3. 0.90 times Debt Service Requirements for such fiscal year (excluding Debt Service Requirements in respect of Subordinated Bonds); provided that, for purposes of this clause Net Revenues shall be calculated to exclude any amounts transferred from the Rate Stabilization Fund to the Revenue Fund.

The following sections provide an overview of Arcadis' work in developing the projection of System revenue requirements and determining necessary revenue increases to comply with the Rate Covenant and maintain targeted reserve fund balances. These sections present analysis and projections that are based on historical audited financial information through FY 2020, as well as preliminary FY 2021 and budgeted FY 2022 data provided by the Water Department.

2.2 Existing Rates and Rate Methodology

In November 2012, the City voted to amend the Home Rule Charter to allow City Council to establish an independent body defined as the Philadelphia Water, Sewer and Storm Water Rate Board (Rate Board). The Rate Board is responsible for fixing and regulating rates and charges for water, sewer and stormwater services; and establishing open and transparent processes and procedures for fixing and regulating rates and charges. The Rate Board consists of five members that are appointed by the Mayor. Members serve staggered terms and continue to serve until the Mayor appoints a replacement. The most recent rate proceeding for the Water Department established water, sewer, and stormwater rates and

charges as of September 1, 2021, for FY 2022. Table 2-1 below reflects the General Service rates and charges in effect as of September 1, 2021. The term General Service refers to the core water, wastewater, and stormwater service provided by the Water Department to its primary customer base consisting of residential, commercial, industrial, and other similar customer types. There are certain customer types that have been granted a reduced rate per Water Department Regulations, including certain senior citizens, schools, and Philadelphia Housing Authority accounts. The Water Department has initiated a tiered assistance program (TAP) for certain qualifying residential customers. TAP allows residents that meet Federal Poverty Limit guidelines to pay for water, sewer, and stormwater service on a percentage of income basis in lieu of using the standard rate schedule. The Water Department requested, and the Rate Board approved, a TAP Rate Rider (TAP Rider) to recover anticipated lost revenue related to the TAP program. The water and wastewater quantity charges below include an incremental $/Mcf (Mcf = thousand cubic feet) amount for the TAP Rider program and are included as part of the Water Department's rates and charges. Other important components that impact the Water Department's rates and charges that have historically been approved by the Rate Board include:

- Establishment of a target of 1.30 for the senior debt service coverage ratio described in Item 1 under Section 2.1 above.
- Establishment of a target of $150 million for combined Residual Fund and Rate Stabilization Fund balances.

Each of these components is reflected in Arcadis' financial projections discussed in the following sections.

The Water Department utilizes a monthly service charge for water and wastewater service that is graduated by meter size. The water quantity charge reflects a declining block structure where the cost per unit of usage in Mcf decreases beyond established thresholds. The wastewater quantity charge is a uniform charge per Mcf for all billable water usage. For certain wastewater customers with higher strength wastewater, surcharges are set for Biochemical Oxygen Demand (BOD) and Suspended Solids (SS) loadings that exceed 250 milligrams per liter (mg/l) and 350 mg/l, respectively. The stormwater charges provide for a residential monthly charge per parcel and an associated billing and collection charge. For non-residential customers, the stormwater charge is based on the amount of gross and impervious area per parcel. These customers also receive a billing and collection charge. The rate and charge structures used by the Water Department for billing customers are generally common within the industry and are appropriate for effectively recovering its cost of providing service.

Table 2-1. General Service Rates and Charges

GENERAL SERVICE RATES AND CHARGES AS OF SEPTEMBER 1, 2021				
Monthly Water and Wastewater Service Charges				
		Water	Wastewater	
Line No.	Meter Size (inches)	Charge Per Bill	Meter Size (inches)	Charge Per Bill
1	5/8	$4.90	5/8	$7.20
2	3/4	$5.28	3/4	$9.16
3	1	$6.46	1	$13.40
4	1-1/2	$8.75	1-1/2	$23.50
5	2	$12.26	2	$36.22
6	3	$19.61	3	$65.25
7	4	$35.46	4	$110.93
8	6	$66.76	6	$218.57
9	8	$101.84	8	$345.77
10	10	$148.99	10	$499.09
11	12	$245.14	12	$906.63
Water and Wastewater Quantity Charges				
		Water	Wastewater	
	Monthly Usage	Unit Charge Per Mcf	Description	Unit Charge
12	First 2 Mcf	$46.68	All Usage ($ / Mcf)	$33.70
13	Next 98 Mcf	$43.02	BOD Surcharge ($ / lb.)	$0.375
14	Next 1,900 Mcf	$33.53	SS Surcharge ($ / lb.)	$0.393
15	Over 2,000 Mcf	$32.63		
Stormwater Charges				
		Residential	Non-Residential	
	Description	Monthly Charge	Description	Monthly Charge
16	Billing & Collection	$1.82	Billing & Collection	$2.36
17	SWMS	$15.04	Gross Area ($/500 s.f.)	$0.724
18			Impervious Area ($/500 s.f.)	$5.117

Notes:
Water and Wastewater Quantity Charges include TAP Rider surcharge
Mcf = Thousand Cubic Feet
BOD = Biochemical Oxygen Demand; SS = Suspended Solids
BOD and SS Surcharges for wastewater strength in excess of 250 milligrams per liter (mg/l) and 350 mg/l, respectively
SWMS = Stormwater Management Service
s.f. - square feet

As part of the most recent rate proceeding that approved the above rates and charges, the Rate Board approved a settlement of disputed issues between the Water Department and intervening parties. Key settlement issues that were approved by the Rate Board include the following:

- FY 2023 Revenue Increase and Reconciliation - Increases to water, sewer, and stormwater revenue of approximately 5.89 percent for FY 2023. The FY 2023 incremental revenue increase is subject to adjustment via a Special Rate Reconciliation Proceeding to be filed by the Water Department on or before March 1, 2022. The revenue increases noted above will be reconciled for two specific items including:
    - Reduction of revenue increases on a dollar-for-dollar basis should the Water Department receive $2.0 million or more in stimulus funding during the period July 1, 2021 through December 31, 2021; however, the reduction cannot reduce the revenue increase below zero dollars.
    - Reduction of revenue increases on a dollar-for-dollar basis should the Water Department's FY 2021 financial performance result in a surplus above a minimum threshold in the Rate

Stabilization Fund; however, the reduction cannot reduce the revenue increase below zero dollars.

The settlement agreement does not define the minimum threshold for the Rate Stabilization Fund. Historically, the Water Department has planned to maintain the Rate Stabilization Fund at a target of $135 million. If the reconciliation proceeding determines the minimum threshold to be less than this historical level, it could potentially result in less revenue and an overall lower Rate Stabilization Fund balance over the next several fiscal years. The financial projection shows that the Water Department has drawn the Rate Stabilization Fund below the $135 million target. The financial projection below reflects projected revenue increases to return the Rate Stabilization Fund to the $135 million targeted reserve.

- Cost of Service - The Water Department will convene stakeholder meetings with the goal of evaluating alternative ways for sharing the costs/benefits of non-residential stormwater remediation projects. The Water Department will also evaluate the potential for creating residential tiers for its stormwater rate structure to reflect different size parcels. The rate design, cost allocations, and cost of service recommendations proposed by the Water Department during the current rate proceeding would be approved.
- Customer Service and Policy Agreements - This includes several provisions related to TAP. During the COVID-19 pandemic (Pandemic) the Water Department has waived the requirement for TAP customers to recertify. The Water Department agrees to keep this policy in place for the near term. For longer-term consideration, the Water Department agrees to consider the merits of establishing a longer period of certification for certain groups of customers, e.g., pensioners, low-income home energy assistance program (LIHEAP) customers, etc.

  Other provisions include the Water Department's agreement to evaluate new approaches for increasing outreach to customers with respect to TAP; increasing language access and interpretation resources; review and evaluate the need to extend the current moratorium to protect public health and safety; and provide greater outreach to customers to improve payment arrangements. The agreement also requires the Water Department to report monthly on the amount and type of arrearage forgiveness provided to TAP customers to determine what legal or operational barriers must be overcome to implement ratable forgiveness for each month the TAP participant pays the TAP bill, and the efforts the Water Department is taking to reduce TAP denials and recertification delays.

While the settlement provides the Water Department with some rate relief in the short term (FY 2022 and FY 2023), there is risk that the incremental increase for FY 2023 could be significantly reduced depending on the FY 2021 and FY 2022 financial performance, receipt of stimulus funding, and the overall outcome of the Special Rate Reconciliation Proceeding. The analysis in this Report assumes the Water Department receives the full benefit of the increased revenues through FY 2028, which provides a baseline of additional revenue to support planned, future capital and operating costs. If the FY 2023 incremental revenue increase is reduced, it is more likely that future, higher revenue increases will be necessary assuming the Water Department's operating and capital expenses remain as projected.

Arcadis notes that after the 2018 rate proceeding, the Office of Public Advocate (Public Advocate) filed an appeal with the Court of Common Pleas of Philadelphia County (Civil Docket Case ID 180800527 (August Term 2018, No. 00527)). The Public Advocate asserted the Rate Board violated the Public Advocate's due process rights because it: (1) failed to avoid even the appearance or lack of impartiality due to the participation of the City Treasurer as a member of the Rate Board; (2) failed to require a legally-sufficient hearing officer report to which the Public Advocate could supply meaningful exceptions; and (3) incorporated and relied upon calculations submitted by the Water Department after the close of the record. On June 24, 2019, the Court of Common Pleas issued an order denying the appeal, and the Public Advocate has now appealed further to the Commonwealth Courts of Common Pleas. On September 24, 2021, the Commonwealth Court delivered an opinion that remanded items (1) and (2) to the Court of Common Pleas for further consideration. The Commonwealth Court also affirmed the decision of the Court of Common Pleas that the ratemaking procedures employed by the City generally provided the Public Advocate with sufficient rights of participation in the rate process and reversed the Court of Common Pleas' conclusion that the 2018 Rate Determination was not appealable. Finally, the Commonwealth Court affirmed the Court of Common Pleas' conclusion that the Public Advocate had ample opportunity to challenge new rate calculations. The City is evaluating its litigation strategy to respond to these findings. It is unknown when the case will finally be resolved, however, the Water Department notes that it usually takes more than two years from the initial appeal filing to resolve Public Advocate appeals. While the final outcome of this litigation is unknown, Arcadis has not assumed any negative financial impact from a potential outcome.

In addition to General Service rates and charges noted in Table 2-1, the Water Department maintains service charges for wholesale water and wastewater customers, private fire service, public fire service, and wastewater surcharges for customers with excessive strength wastewater loadings of BOD and SS. The wholesale charges are outlined by individual contracts, but generally include provisions to recover certain O&M and capital costs for system components that serve the wholesale customers. Public Fire Service is recovered via a payment from the City and reflects O&M and capital costs for water system components related to providing public fire protection such as hydrants and associated water mains.

2.3 Projected Revenues Under Existing Rates

Arcadis developed a projection of revenue under existing rates and charges for the Water Department. The projection of revenue under existing rates provides a baseline for determining potential additional revenue increases to meet the operating and capital costs of the System.

2.3.1 Projection of General Service Revenue

General Service revenue is dependent on the number of customers and associated billing units for these customers. Arcadis reviewed the historical and current levels of customers (associated monthly bills), water usage, and stormwater gross and impervious area units to determine the general trend in number of customers and billing units. In addition, customer usage, billing, and payment data generated during the Pandemic and periods prior to the Pandemic were reviewed to determine the impact of the Pandemic on the Water Department's billed water usage and associated revenue. Based on the review, the following assumptions were incorporated into our estimate of FY 2022 service revenue, and projected revenue under existing rates and charges for the projection period as seen on Table 2-2 below.

- The number of water, wastewater, and stormwater customers has been generally stable in recent years. Arcadis' projection reflects a stable number of customers and associated monthly bills for the projection period.
- Prior to the Pandemic, the amount of billed water usage per monthly bill had been steadily declining. Based on recent trends, it is projected that annual billed usage (impacting water and wastewater quantity charge revenue) will decrease by approximately 1.25 percent per year for the projection period.
- The effective collection rate for water, sewer, and stormwater revenue will be approximately 96.3 percent of billings for FY 2022.
- For stormwater service, the Water Department maintains a credit program for certain customers that undertake parcel improvements to mitigate stormwater runoff from gross and impervious areas. The credits provide for a decrease in non-residential gross and impervious area billing units and associated revenue. Based on our review of recent data, it is projected that stormwater revenue will decrease approximately 0.3% per year for the projection period related to continuation of the credit program.
- During the first part of the Pandemic from FY 2020 into FY 2021, there was significant impact to overall usage, billings, and payments when compared to the average of the pre-Pandemic months. Following the initial disruption related to stay-at-home orders and business closures to mitigate the spread of the coronavirus, the trends in usage and billings increased and Arcadis has assumed that the estimates will gradually trend higher toward pre-Pandemic levels as the Pandemic abates and economic conditions improve. It is estimated that overall usage, billings, and payment patterns will achieve pre-Pandemic levels in approximately FY 2024. However, it is noted that the Pandemic and associated economic recovery is still ongoing and the full extent of the impact to the Water Department's projected customers, billed usage, payments, and overall revenue is still unknown at this point.
- The shut-off moratorium for delinquent residential customers will end in April 2022 at which time shut-offs will resume to deter delinquencies and improve collected revenue. Services are currently only shut-off if a customer's meter is in non-compliance.

2.3.2 Other Operating Revenue

In addition to the revenue from General Service rates and charges noted above, the Water Department also derives revenue from the following service charges:

- Wholesale Service Charges – The Water Department maintains wholesale service contracts with several adjacent communities and/or utilities, including:
    - Wastewater Service
        - Delaware County Regional Water Quality Control Authority (DELCORA)
        - Cheltenham Township (owned by Aqua Pennsylvania Wastewater, Inc.)
        - Bucks County Water and Sewer Authority (includes Springfield and Bensalem)

        - Lower Merion Township
        - Upper Darby Township
        - Lower Southampton Township
        - Abington Township
        - Lower Moreland Township
    - Water Service
        - Aqua Pennsylvania

  The contracts generally provide for the recovery of O&M and capital costs for portions of the systems that serve these customers. For several of the contracts including DELCORA, the Water Department is able to recover a portion of its costs related to its Consent Order & Agreement (COA). In FY 2020, DELCORA was purchased by Essential Utilities, Inc. (formerly Aqua America). The purchase is currently being challenged in court by Delaware County; however, Essential Utilities, Inc. has indicated that it eventually plans to disconnect its sewer system from the Water Department's system once an expansion of the existing DELCORA treatment plant is completed. The Water Department's agreement with DELCORA is expected to end on April 1, 2028 and will likely not be renewed. The annual payment from DELCORA to the Water Department for service is approximately $10 million and is included in Line 11 of Table 2-2. The projection included in this Report is through FY 2028. This Report assumes the Water Department will no longer receive revenue from DELCORA beginning in FY 2029, which is beyond the projection period.

- Private Fire Protection – Certain customers maintain private fire systems in addition to their general service, and the Water Department maintains a monthly charge graduated by meter size to recover a portion of the water system costs related to serving these customers.
- Public Fire Protection – The Water Department maintains hydrants and capacity in its water system to support fire suppression for the public. This charge is billed and recovered on an annual basis via the City General Fund.
- Wastewater Surcharge – For certain customers with high strength wastewater, the Water Department maintains a wastewater surcharge for wastewater with pollutant loadings above established thresholds.

Table 2-2 presents the projection of revenue under existing rates and charges. Lines 1 through 2 and Lines 7 through 9 reflect the application of the current rates and charges to the estimated customer billing units for the projection period.

Table 2-2. Projected Revenue Under Existing Rates and Charges ($1,000s)

Line No.	Description	Fiscal Year Ending June 30, 2022	2023	2024	2025	2026	2027	2028
	Operating Revenue							
	Water Service							
1	Retail Volume Revenue	228,086	227,030	224,986	222,174	219,397	216,654	213,946
2	Retail Fixed Revenue	30,463	30,703	30,811	30,811	30,811	30,811	30,811
3	Private Fire Protection	3,976	3,976	3,976	3,976	3,976	3,976	3,976
4	Public Fire Protection	6,598	6,598	6,598	6,598	6,598	6,598	6,598
5	Wholesale Water	3,877	3,877	3,877	3,877	3,877	3,877	3,877
6	Total Water Service	273,000	272,184	270,248	267,436	264,659	261,916	259,208
	Wastewater Service							
7	Retail Volume Revenue	177,062	176,243	174,656	172,473	170,317	168,188	166,086
8	Retail Fixed Revenue	45,644	46,003	46,164	46,164	46,164	46,164	46,164
9	Stormwater	183,145	184,000	184,055	183,466	182,879	182,294	181,711
10	Wastewater Surcharge	5,074	5,074	5,074	5,074	5,074	5,074	5,074
11	Wholesale Wastewater	40,578	40,578	40,578	40,578	40,578	40,578	40,578
12	Total Wastewater Service	451,503	451,898	450,528	447,756	445,013	442,298	439,613
	Other Revenue							
13	Other Operating Revenue	11,820	14,894	17,303	16,676	16,011	15,307	14,560
14	Interest Income	2,899	2,910	2,906	2,882	2,857	2,833	2,809
15	Transfer From Debt Reserve Account	5,000	0	0	0	0	0	0
16	Total Other Revenue	19,719	17,804	20,209	19,557	18,869	18,140	17,369
17	**Total Water Department Revenue**	**744,223**	**741,886**	**740,985**	**734,749**	**728,540**	**722,354**	**716,190**

Note: Minor variances in summations due to rounding.

Other service revenue such as Private Fire Protection (Line 3); Public Fire Protection (Line 4); Wholesale Water (Line 5); Wastewater Surcharge (Line 10); and Wholesale Wastewater (Line 11) are based on FY 2021 preliminary results for the Water Department. These amounts are generally projected to remain stable for the projection period but are subject to increases through the Water Department's regular rate proceedings and wholesale contract management process.

Other operating revenue seen on Line 13 consists of interest and penalty revenue; miscellaneous service revenue, and revenue offsets related to the TAP program. Interest and penalty revenue has been relatively lower compared to pre-Pandemic levels due to the moratorium on shut offs. It is assumed that this will gradually return to a level of approximately $10 million annually by FY 2024. The TAP program has anticipated revenue offsets based on an analysis provided by the Water Department. For purposes of this projection, Arcadis has assumed that TAP offsets will increase approximately 6.0 percent per year from FY 2022 to FY 2028 as follows:

- FY 2022 - $9,300,000
- FY 2023 - $9,858,000
- FY 2024 - $10,449,500
- FY 2025 - $11,076,500
- FY 2026 - $11,741,100
- FY 2027 - $12,445,600
- FY 2028 - $13,192,300

Interest income (Line 14) consists of interest income from the Revenue Fund and Rate Stabilization Fund and is determined using projected fund balances and an annual interest rate of 1.0 percent. Line 15 shows an estimate of $5 million in excess funds transferred from the Debt Reserve Account to the Revenue Fund in FY 2022 only. Line 17 shows the projected Water Department revenue at approximately $744 million in FY 2022 and decreasing to approximately $716 million by FY 2028.

2.4 Operation and Maintenance Expenses

Operation and Maintenance expenses consist of the necessary and recurring costs to effectively operate and maintain the System so that it performs as intended. In general, O&M consists of expenses related to Water Department divisions, e.g., Operations, Planning and Environmental Services, and Finance, as well as interdepartmental expenses for support received from City General Fund units, e.g., Law, Finance, and Information Technology. These combined expenses reflect Water Fund O&M revenue requirements. The following reflects the general O&M expense categories incurred by the Water Department:

Table 2-3. Operation and Maintenance Expense Categories

Account No.	Category	Description
100	Personal Services	Expenses related to salaries, fringe benefits, pension costs, overtime and other employee cost items
200	Purchase of Services	Expenses related to contracts or services from external entities, including electricity and natural gas service
300/400	Materials Supplies and Equipment	Miscellaneous supplies and equipment, including water treatment chemicals
500	Contributions Indemnities and Taxes	General expenses related to lawsuits
800	Payments to Other Funds	Additional O&M payment to the General Fund associated with the direct interdepartmental services provided to the Water Department by the City

Arcadis utilized the FY 2021 preliminary actual results and FY 2022 Water Fund budget as a baseline for developing the O&M projection which is presented in Table 2-4. The budgeted expenses were adjusted downward to recognize that historically, actual O&M obligations have been less than budgeted. The adjustment was made by applying a factor derived from a historical look at actual obligations to the budget by expense category. The O&M is further reduced by liquidated encumbrances, which are anticipated O&M obligations that are ultimately not spent in the fiscal year.

The O&M projection includes additional Personal Services costs to reflect increased staffing related to implementation of the COA as well as a shift of staff previously funded from the capital budget to the operating budget. The projection also includes additional Purchase of Services obligations related to maintenance improvements beginning in FY 2024 of approximately $8.0 million.

As noted in Section 4.0 of this Report, the Lead and Copper Rule Revision (LCRR) has been released but is still in the process of being finalized. At this time, the Water Department is evaluating the impact on its operations and costs, as well as options for how to recover the costs from rates and charges or other sources. Due to the uncertainty of potential LCRR costs at this point, there is not an additional cost included in the O&M projection. Should significant LCRR costs become necessary, we assume the Water Department will make internal budget adjustments, or seek the appropriate additional revenue increases to cover these costs as necessary. Similarly, the Water Department is in negotiations with the Pennsylvania Department of Environmental Protection (PADEP) regarding a new Municipal Separate Storm Sewer System (MS4) permit, which could potentially require a pollutant reduction plan among other requirements that could result in additional costs to the Water Department. Due to the uncertainty of potential costs to comply with future MS4 permit conditions, there is not an additional cost included in the O&M projection. Should significant MS4 permit compliance costs become necessary, we assume the Water Department will make internal budget adjustments, or seek the appropriate additional revenue increases to cover these costs as necessary.

Table 2-4 presents the Water Fund O&M for the projection period. The majority of O&M is related to Personal Services, including Fringe Benefits, which include employee costs related to health insurance, as well as pension costs which comprise nearly 45 percent of the annual Personal Services amount.

Table 2-4. Projected Operation and Maintenance Expenses ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
	Water Department O&M							
1	Personal Services	135,464	141,242	147,070	154,318	161,886	169,855	178,177
2	Purchase of Services	170,050	176,638	188,825	192,879	196,429	200,376	204,406
3	Materials Supplies and Equipment	49,909	55,197	56,425	57,680	58,964	60,277	61,619
4	Contributions Indemnities and Taxes	500	510	520	531	541	552	563
5	Other - Payment to General Fund	7,700	7,854	8,011	8,171	8,335	8,501	8,671
6	Subtotal Water Department O&M	363,623	381,441	400,851	413,580	426,155	439,562	453,437
	Interdepartmental O&M							
7	Personal Services - Non Fringe Benefits	23,904	24,549	25,212	25,893	26,592	27,310	28,047
8	Personal Services - Fringe Benefits	126,977	133,417	138,307	143,524	149,092	154,755	160,679
9	Purchase of Services	28,205	29,616	30,356	31,115	31,893	32,690	33,507
10	Materials Supplies and Equipment	5,153	5,411	5,546	5,685	5,827	5,972	6,122
11	Contributions Indemnities and Taxes	2,614	2,666	2,719	2,774	2,829	2,886	2,943
12	Subtotal Interdepartmental Charges	186,853	195,659	202,140	208,990	216,233	223,613	231,299
	Combined O&M							
13	Subtotal Operating Expenses	550,477	577,100	602,991	622,569	642,388	663,175	684,735
14	Less: Liquidated Encumbrances	(27,997)	(28,837)	(29,702)	(30,593)	(31,511)	(32,456)	(33,430)
15	**Total Operating Expenses**	**522,480**	**548,263**	**573,289**	**591,976**	**610,877**	**630,719**	**651,306**

Note: Minor variances in summations due to rounding.

The total O&M for the Water Department increases from approximately $522 million in FY 2022 to $651 million by FY 2028. Beyond FY 2022, the O&M increases include reasonable annual inflation factors as follows:

- Water Department Personal Services - 3.09% FY 2023-FY 2024; 2.7% FY 2025–FY 2028

- Health Care (Fringe Benefits) - 4.15% effective based on City projection
- Purchase of Services (Electric) - 1.5% FY 2023; 1.0% FY 2024 – FY 2027
- Purchase of Services (Gas) - 3.0% FY 2023; 1.5% FY 2024; 1.0% FY 2025 – FY 2027
- Purchase of Services (Other/Non-SMIP/GARP) - 5.0% FY 2023; 2.5% FY 2024 – FY 2028
- Materials & Supplies (Chemicals) - 27.5% increase to FY 2021 level for FY 2023; 2.0% FY 2024 – FY 2028
- Materials & Supplies (Other) - 5.0% FY 2023; 2.5% FY 2024 – FY 2028
- Contributions, Indemnities, Taxes - 2.0%

The projection assumes there will be relatively higher inflation related to Purchase of Services and Materials, Supplies, and Equipment for FY 2023, followed by more moderate inflation levels through FY 2028. The FY 2023 increase related to chemicals is based on discussions with Water Department operations staff. The effective annual increase in O&M for the projection period is approximately 3.7%. Arcadis believes the assumed inflation increases are reasonable for this Report. Should future annual inflation be materially higher than this projection, it is assumed that the Water Department will make necessary adjustments to operations or finances to ensure the System remains in good working order.

2.5 Capital Improvement Program and Funding

2.5.1 Capital Improvement Program

The Water Department provided Arcadis with its preliminary FY 2023 to FY 2028 CIP, which is reflected below in Table 2-5. The Table also reflects the level of project commitments anticipated for each year of the projection period. Project commitments are generally contractual project costs that the Water Department is obligated to pay as capital projects are bid and constructed. The City has informed the Water Department that in terms of project financing, it should plan to have cash on hand to meet its anticipated, outstanding project commitments.

The CIP reflects planned improvements to the System, including continued work on projects related to its COA. The CIP also includes projects related to its Drinking Water Master Plan, as well as significant renewal and replacement projects at the Baxter, Queen Lane, and Belmont water treatment facilities, as well as the Northeast, Southeast, and Southwest Water Pollution Control Plants (WPCPs). The total CIP budget is reflected on Line 10. The current year (FY 2022) is shown and Line 11 reflects an adjustment to carryforward a portion of the FY 2021 authorized capital budget that was delayed due to the Pandemic. The adjusted CIP is reflected on Line 12. The FY 2023 CIP budget has been submitted to the City for consideration, and it is assumed it will be approved in the Spring of 2022. Beyond FY 2023, Arcadis adjusted the annual CIP budget for inflation. Line 13 reflects the annual inflation factors applied to FY 2024 through FY 2028. These inflation factors reflect that recent cost indices have been reflecting higher inflation for construction services. Arcadis assumes an inflation factor of 6.0% in FY 2024, decreasing to 4.0% in FY 2025, and 3.0% in FY 2026 through FY 2028. Arcadis notes that the current environment with respect to inflation is relatively uncertain compared to recent historical years. We have assumed near-

term price inflation with respect to the CIP that is higher than in recent years, and then a gradual return to an annual rate of approximately 3.0%. We believe this is a reasonable assumption; however, actual results may differ from this projection, and Arcadis assumes that the Water Department will take the necessary steps to manage the CIP implementation and its finances to ensure the System remains in good operating and financial condition.

Line 16 reflects annual project commitments anticipated to be initiated by the Water Department. The Water Department indicates that it generally achieves bidding approximately 80 percent of budgeted CIP each year. For FY 2022 and FY 2023, Arcadis has used a value of 85 percent as a conservative adjustment to reflect the potential impact of inflation for these two years. Beyond FY 2023, the project commitment to budget factor is anticipated to return to a level of 80 percent.

Table 2-5. Capital Improvement Program Budget and Project Commitments ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
1	Water & WW Plants and Facilities	250,550	255,000	326,000	168,000	455,000	195,000	130,000
2	Sewer and CSO System Improvements	45,260	72,860	78,860	83,860	89,860	94,860	100,860
3	Water Conveyance System Improvements	30,760	123,060	120,060	315,060	122,060	130,060	120,060
4	Flood Relief	0	15,000	15,000	15,000	15,000	15,000	15,000
5	Stream Restoration	0	10,000	10,000	10,000	10,000	10,000	10,000
6	Green Stormwater Infrastructure	20,000	73,000	73,000	73,000	146,000	146,000	146,000
7	Vehicles and Equipment	12,000	12,000	12,000	12,000	12,000	12,000	12,000
8	Meters	5,000	5,000	5,000	5,000	5,000	5,000	5,000
9	Engineering and Administration	15,319	14,321	14,321	14,321	14,321	14,321	14,321
10	**Total CIP**	**378,889**	**580,241**	**654,241**	**696,241**	**869,241**	**622,241**	**553,241**
11	FY 2021 Budget Carryforward [1]	232,111						
12	**Total CIP**	**611,000**	**580,241**	**654,241**	**696,241**	**869,241**	**622,241**	**553,241**
13	Inflation Rate [2]			6.0%	4.0%	3.0%	3.0%	3.0%
14	**Total CIP Adjusted for Inflation**	**611,000**	**580,241**	**693,495**	**767,536**	**986,999**	**727,733**	**666,446**
15	Project Commitment to Budget Factor [3]	85.00%	85.00%	80.00%	80.00%	80.00%	80.00%	80.00%
16	**Estimated Project Commitments Bid**	**519,350**	**493,205**	**554,796**	**614,029**	**789,599**	**582,187**	**533,157**

[1] **Reflects approved FY 2021 project commitments moved to FY 2022 due to the Pandemic.**
[2] **Annual CIP budget adjusted for inflation after FY 2023.**
[3] **FY 2022 to FY 2028 project commitments to Adjusted CIP Budget (Line 16 / Line 14).**

2.5.2 Capital Flow of Funds

2.5.2.1 Commercial Paper Program

The Water Department is in the process of using Pennsylvania Infrastructure Investment Authority (Pennvest) loans in conjunction with a Commercial Paper (CP) Program (CP Program) to fund a portion of the CIP under the Twenty-Fifth Supplemental Ordinance from the City Council. The CP Program will provide the Water Department an interim, short-term financing product to meet immediate capital spending needs while processing the disbursement of Pennvest funds. The Twenty-Fifth Supplemental Ordinance provides for the issuance of obligations under the CP Program (CP Obligations), on a revolving basis, in an aggregate principal amount not greater than $400 million at any time outstanding.

The Water Department has selected two vendors to help initiate the CP program in FY 2022 and has closed on Water and Wastewater Revenue Commercial Paper notes in an amount not to exceed $250 million.

CP Obligations, when issued under the Twenty-Fifth Supplemental Ordinance, will constitute Bonds under the General Ordinance. As such, any financial covenant or reserve calculation to be made per the General Ordinance will be required to include any principal of or interest on CP Obligations if it is to be paid from Project Revenues and other amounts deposited or credited to the Debt Service Account of the Sinking Fund[1]. It is expected that principal of CP Obligations will be paid from proceeds of Pennvest loans subsequently issued for such purpose, and that only interest on CP Obligations will be paid from the Debt Service Account of the Sinking Fund.

The Water Department is in the beginning stages of implementing the CP Program in conjunction with projects approved for Pennvest funding. Certain projects approved for Pennvest Loans through the projection period will utilize the CP Program for short-term financing to meet the immediate capital needs of the projects. The Water Department will then submit reimbursement requests to Pennvest and use the reimbursement proceeds to repay the CP Obligations drawn principal amounts. Ultimately, the Pennvest reimbursements will be converted to long-term senior debt service that is reflected in Table 2-9. The following Table 2-6 reflects the estimated implementation of several projects to be completed using the CP Program and Pennvest loans. The Table shows estimated Pennvest Loan draws for each fiscal year. There is an additional Pennvest loan for the Torresdale Pump Station Rehabilitation project that closed in February 2021; however, project costs for this project are being initially paid from the Water Department's self-generated capital funds.

Table 2-6. Projects Funded via CP Program and Pennvest Loans and Estimated Draw Amounts ($1,000s)

Line No.	Description			Fiscal Year						
	Pennvest Projects	Loan Amount	Closing Date	2022	2023	2024	2025	2026	2027	2028
1	Lawncrest	5,794	Oct-21	1,690	2,897	1,207				
2	PTB Construction	95,015	Feb-22		19,003	19,003	19,003	19,003	19,003	
3	PTB Engineering	5,100	Feb-22		1,020	1,020	1,020	1,020	1,020	
4	Flat Rock Dam	20,960	Jul-22		3,843	4,192	4,192	4,192	4,192	349
5	Linear Assets	40,356	Oct-22		13,452	20,178	6,726			
6	**Total Estimated Pennvest Draws**			**1,690**	**40,215**	**45,600**	**30,941**	**24,215**	**24,215**	**349**

Note: Closing dates and project draws are estimated and subject to change.

The following Table 2-7 reflects the estimated use of the CP Program for the projection period, and was developed based on discussions with the Water Department as to the expected general function of the CP Program and associated CP interest, including the repayment of CP using Pennvest Loan proceeds. As seen, Line 2 shows the estimated CP Program draws to pay costs related to the Pennvest projects noted above. Project invoices are submitted to Pennvest by the Water Department for reimbursement. As the Water Department is reimbursed from Pennvest, it will repay the CP as shown on Line 3. The outstanding CP balance is shown on Line 4 and is within the $250 million authorized principal limit. Line 5 reflects estimated CP interest which are considered Debt Service Requirements, and which are also

[1] This excludes principal, redemption price and interest paid with proceeds of Bonds to be paid out of a redemption subaccount established specifically therefor or other refunding and/or defeasance escrow to be held by the Fiscal Agent.

reflected on Table 2-9 and Table 2-10 which present the Water Department's projected debt service for the projection period.

Table 2-7. Estimated Use of Commercial Paper Program ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
1	Beginning of FY CP Outstanding Balance	0	793	9,477	9,394	5,590	5,375	5,660
2	CP Issued	2,000	41,500	46,000	30,500	24,000	24,500	0
3	Repayment of CP Outstanding From Pennvest Proceeds	(1,207)	(32,816)	(46,083)	(34,304)	(24,215)	(24,215)	(4,385)
4	End of FY CP Outstanding Balance (Sum Ln. 1 - Ln. 5)	793	9,477	9,394	5,590	5,375	5,660	1,275
5	Annual Interest Payment (Variable Averaging 1.0%)	4	76	89	64	51	52	15

Table 2-7 Key CP Program Assumptions:

- **Line 2: Water Department will utilize approximately $170M from FY 2022 to FY 2027 to fund projects approved for Pennvest loans.**
- **Line 3: CP obligations will be paid via Pennvest reimbursements.**
- **Lines 1 and 4: The outstanding balance for the CP Program will be maintained below the authorized amount of $250M.**
- **Line 5: Annual interest will be accrued and paid similar to the Water Department's other senior debt service.**

2.5.2.2 Construction Fund

The Construction Fund is established per the General Ordinance and provides accounting for the funding and completion of the Water Department's capital projects. Its sources generally include revenue bond proceeds, cash transfers from the Revenue Fund and Residual Fund, and CP Program proceeds. The funding of capital needs noted above in the CIP is shown in Table 2-8. As can be seen, Lines 1 through 5 present anticipated revenue bond issuances and transfers to occur during the projection period. Line 1 presents the anticipated total revenue bond issuances for the projection period. Bond issuances are projected to be needed during each of the fiscal years to meet the Water Department's capital needs. Lines 2 through 4 present bond proceed uses including the transfer to the Construction Fund (Line 2) for the completion of capital projects; transfer to the Debt Reserve Account to maintain reserve balance (Line 3); and payment of bond issuance expenses (Line 4). It is noted that during the projection period, the Water Department could utilize other Pennvest Loans or other funds such as project loans obtained via the USEPA Water Infrastructure Finance and Innovation Act (WIFIA). At the time of this Report, it is not certain how much of the CIP could be funded via additional Pennvest Loans or WIFIA. Therefore, Arcadis assumes that revenue bonds and cash generated from operations will be the primary sources for funding for the CIP projects that are not already approved for Pennvest Loans.

2.5.2.2.1 Construction Fund Sources of Capital Funding

To meet the projected capital project needs over the projection period, the Water Department relies on several sources, including self-generated cash from operations, as well as debt issuances to cover large, longer-term projects. At the beginning of FY 2022, the Water Department had approximately $431.2 million of cash on hand in the Construction Fund (Line 6).

Line 7 presents the projected net revenue bond proceed transfers to the Construction Fund for the projection period. At the beginning of FY 2022 the Water Department completed the Series 2021C bond

issuance which provided $275 million for the Construction Fund. The bond proceeds for FY 2022 plus the proceeds projected for FY 2023 through FY 2028 are seen on Line 7 and average approximately $468 million annually.

The Water Department is in the process of using reimbursements from a Pennvest Loan of approximately $80 million to rehabilitate its Torresdale Pump Station. Line 8 reflects estimated reimbursements available to the Water Department Construction Fund as it draws down the loan over the project completion period. The estimated reimbursements are expected to be available for use on future projects beginning in FY 2024 and reflect a one-year lag related to achieving budget authorization.

As noted above and seen on Table 2-6, there are several projects approved for Pennvest Loans that will utilize the CP Program for initial funding. Line 9 presents the use of proceeds from the CP Program to fund these projects. For this Report, it is assumed the Water Department will utilize approximately $170 million of Commercial Paper from FY 2022 to FY 2027 to provide interim, short-term financing of a portion of its CIP that have been approved for Pennvest loans. The Water Department may choose to utilize additional Commercial Paper to fund other future projects as outstanding CP balances are repaid from Pennvest proceeds.

Line 10 presents the Capital Account Deposit Amount. The Capital Account is an account established within the Construction Fund. Per the General Ordinance, the Water Department is required to transfer an amount at least equal to one percent of the depreciated value of property, plant, and equipment as sufficient to make renewals, replacements, and improvements to the System[2]. Arcadis determined the Capital Account Deposit Amount by projecting the estimated depreciated value of property, plant, and equipment. We used a one percent value for each fiscal year to determine the annual Capital Account Deposit Amount for the projection period. The annual transfers from the Revenue Fund to the Construction Fund are seen on Line 10 of Table 2-8 and are available for use by the Water Department for capital projects.

Per the General Ordinance, the Water Department may make transfers from the Residual Fund to the Construction Fund for the purpose of funding capital projects. Line 11 of Table 2-8 reflects the projected transfers from the Residual Fund to the Construction Fund. As is shown, it is projected that the Water Department will increase annual cash funding of capital from approximately $57 million in FY 2022 to approximately $109 million by FY 2028 (sum of Lines 10 and 11).

The main sources described above are supplemented by interest income (Line 12) to yield the total sources available on Line 13. Each year, the Water Department disburses cash to meet its project commitments as capital projects are constructed. Based on discussions with the Water Department, Arcadis estimates annual cash disbursements for capital projects will grow to approximately $508 million by FY 2024 and continue growing through FY 2028 to approximately $650 million. The estimated end of year net cash sources available is seen on Line 15.

[2] Alternatively, the City may deposit such greater amount annually certified by the Consulting Engineer as sufficient to make renewals, replacement and improvements in order to maintain adequate water and wastewater services to the areas served by the System.

Table 2-8. Construction Fund Flow of Funds ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
	Revenue Bond Proceeds							
1	Estimated Total Bond Issue	276,613	415,160	472,910	573,515	641,510	460,765	450,015
	Transfers:							
2	Construction Fund	275,001	386,487	438,293	531,299	593,302	438,931	419,862
3	Debt Reserve Account	0	25,767	31,306	38,201	43,718	18,609	27,003
4	Bond Issuance Expenses	1,612	2,906	3,310	4,015	4,491	3,225	3,150
5	Total Transfer of Proceeds (Lines 2+3+4)	276,613	415,160	472,910	573,515	641,510	460,765	450,015
	Construction Fund							
	Sources:							
6	Beginning Cash Balance	431,224	348,479	413,341	470,181	532,961	649,954	607,228
7	Net Revenue Bond Proceeds	275,001	386,487	438,293	531,299	593,302	438,931	419,862
8	Pennvest Loan Reimbursement - Torresdale	0	0	13,470	16,164	16,164	16,164	16,164
9	CP/Pennvest Loan Proceeds [1 & 2]	2,000	41,500	46,000	30,500	24,000	24,500	0
10	Capital Account Deposit Amount	29,781	31,866	34,096	36,483	39,037	41,769	44,693
11	Transfer from Residual Fund to Capital Account	27,022	20,917	29,125	38,353	51,211	61,447	64,297
12	Interest Income	3,450	4,092	4,655	5,277	6,435	6,012	5,017
13	Subtotal Cash Available (Sum of Ln 6 - 12)	768,479	833,341	978,981	1,128,257	1,263,109	1,238,778	1,157,263
14	Cash Spend on Project Commitments [3]	(420,000)	(420,000)	(508,800)	(595,296)	(613,155)	(631,550)	(650,496)
15	**Net Sources Available (Line 13+14)**	**348,479**	**413,341**	**470,181**	**532,961**	**649,954**	**607,228**	**506,767**
	Uses:							
16	Beginning of Year Commitments	210,000	309,350	382,555	428,551	447,284	623,728	574,366
17	Torresdale Project Commitment	13,470	16,164	16,164	16,164	16,164	2,694	0
18	CP Project Commitment	1,690	40,215	45,600	30,941	24,215	24,215	349
19	Other Project Commitments	504,190	436,826	493,032	566,924	749,220	555,278	532,808
20	Subtotal Project Commitments (Sum Ln 16 - 19)	729,350	802,555	937,351	1,042,580	1,236,883	1,205,915	1,107,523
21	Cash Spend on Project Commitments [3]	(420,000)	(420,000)	(508,800)	(595,296)	(613,155)	(631,550)	(650,496)
22	**Net Commitments (Line 20+21)**	**309,350**	**382,555**	**428,551**	**447,284**	**623,728**	**574,366**	**457,027**

[1] Debt service associated with Pennvest Loans is senior debt service.
[2] Reflects use of CP Obligations to fund a portion of annual capital project commitments as described in Section 2.5.2.1 of this Report. Interest payments associated with CP Program are senior debt service.
[3] Assumes the monthly cash spend will average $35 million in FY 2022 and FY 2023; increase to $40 million in FY 2024; and increase to $45 million for FY 2025 through FY 2028. Inflation included for FY 2024 through FY 2028 at annual rates of 6.0%, 4.0%, 3.0%, 3.0%, and 3.0%, respectively.
Note: Minor variance in summations due to rounding.

2.5.2.2.2 Uses of Capital Funds

The Construction Fund is used for the payment of capital project design and construction costs. Table 2-8, Line 16 reflects the Beginning of Year project commitments. At the start of FY 2022, Arcadis estimates the Water Department had approximately $210 million in project commitments and anticipates an additional $519 million during FY 2022 as seen on Lines 17 through 19. Beyond FY 2022, the estimated project commitments initiated each year are expected to grow through FY 2026 to approximately $790 million, and then trend down to $533 million in FY 2028. The project commitments related to the Torresdale Pump Station are seen on Line 17. Line 18 presents the project commitments for the projects funded via the CP Program and associated Pennvest Loans. Line 19 shows all other project commitments for the projection period. Total project commitments (Line 20) are reduced as cash is disbursed for project costs. As noted above for Line 14, and reflected again on Line 21, cash disbursements are expected to increase to approximately $650 million as projects are completed through

the projection period. The Net Sources Available (Line 15) are sufficient to meet the Net Project Commitments (Line 22) for the projection period FY 2022 through FY 2028.

2.6 Existing and Projected Debt Service

Including the issuance of the Series 2021C debt that closed in October of 2021 and the Torresdale and Lawncrest Pennvest Loans, the Water Department currently has approximately $2.6 billion in outstanding debt, including revenue bonds and Pennvest Loans outstanding. Lines 1 through 3 of Table 2-9 provide a summary of the existing debt service by fiscal year for the projection period. Line 1 reflects existing debt service, including Series 2021C issuance. Line 2 and Line 3 reflect the estimated outstanding debt service for the Torresdale and Lawncrest Pennvest Loan agreements that were estimated using the following key assumptions that are derived from discussions with the Water Department and its municipal advisor[3]:

- Project draw amounts and schedules will occur as seen on Tables 2-6 and Table 2-8 and are subject to change if the actual loan draw amounts differ during the project construction period.
- The Term for each Pennvest Loan is 20 years from the date of the first Pennvest reimbursement.
- The debt service schedules assume interest only payments using a one percent annual interest rate on the aggregate principal amount drawn for up to three years during the project construction period.
- Following the construction period, the debt service includes level principal and interest payments on the aggregate principal amount drawn using a one percent annual interest rate through the first five years from first project disbursement.
- Beyond the first five years after the date of the first Pennvest reimbursement, the debt service includes level principal and interest payments on the aggregate principal amount drawn using a 1.73 percent annual interest rate from Year 6 through Year 20.

Line 5 presents the projected Commercial Paper interest that is senior debt service for this Report. Lines 6 through 8 reflect the estimated future debt service for Pennvest Loans that are currently in the approval process at Pennvest. The debt service related to these Pennvest Loans is estimated using the same key assumptions above, however, the annual interest rate used for years 6 through 20 is assumed to be 2.0 percent.

As reflected above in Table 2-8, the Water Department will rely on regular issuances of revenue bonds to fund a portion of its capital needs over the projection period. Lines 9 through 14 of Table 2-9 present the projected debt service by fiscal year. The projected revenue bond debt service is determined using the following assumptions:

- Level annual debt payment
    - 30-year term

[3] The assumptions related to projected Pennvest Loan debt service are based on discussions with the Water Department and its municipal advisor. The actual principal and interest payments will be determined based on the evolving draw of funds as the projects are completed, as well as the overall completion dates for the projects which at this point are estimated. While Arcadis believes the estimated Pennvest Loan debt service amounts in this Report are reasonable for projection purposes, the actual annual amounts could be materially different.

- 5.4 percent average annual interest rate based on the following interest rates and par value amounts:
  - Series 2022 (FY 2023) – Par Value of $415,160,000 at 5.00 percent
  - Series 2023 (FY 2024) – Par Value of $472,910,000 at 5.25 percent
  - Series 2024 (FY 2025) – Par Value of $573,515,000 at 5.25 percent
  - Series 2025 (FY 2026) – Par Value of $641,510,000 at 5.50 percent
  - Series 2026 (FY 2027) – Par Value of $460,765,000 at 5.50 percent
  - Series 2027 (FY 2028) – Par Value of $450,015,000 at 5.75 percent
- Initial, semi-annual interest payment in fiscal year of issuance

Table 2-9. Existing and Projected Debt Service ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
1	Existing Debt Service [1]	177,015	183,189	170,403	170,538	171,537	171,571	157,063
2	Torresdale Pennvest Debt Service	40	195	357	2,485	4,394	5,429	5,573
3	Lawncrest Pennvest Debt Service	3	28	176	352	352	360	371
4	**Subtotal Existing Debt Service (Sum Ln. 1 to Ln. 3)**	**177,058**	**183,413**	**170,936**	**173,375**	**176,283**	**177,360**	**163,007**
	Projected Debt Service							
5	FY 2022 - Commercial Paper Interest	4	76	89	64	51	52	15
6	FY 2022 - PTB (Engineering & Construction) Pennvest Series		76	275	476	3,798	5,672	6,948
7	FY 2023 - Flat Rock Dam Pennvest Series		13	54	96	719	1,164	1,442
8	FY 2023 - Linear Assets Pennvest Series		29	210	1,406	2,451	2,451	2,543
9	FY 2023 - Series 2022		7,784	26,720	26,717	26,717	26,716	26,717
10	FY 2024 - Series 2023			9,310	31,308	31,304	31,306	31,308
11	FY 2025 - Series 2024				12,127	37,422	38,201	38,187
12	FY 2026 - Series 2025					13,721	43,666	43,668
13	FY 2027 - Series 2026						9,855	31,362
14	FY 2028 - Series 2027							10,063
15	**Subtotal Projected Debt Service (Sum Ln. 5 to Ln. 14)**	**4**	**7,979**	**36,659**	**72,194**	**116,184**	**159,083**	**192,253**
16	**Total Debt Service (Ln. 4 + Ln. 15)**	**177,062**	**191,392**	**207,595**	**245,569**	**292,467**	**336,443**	**355,260**

[1] Includes Series 2021C debt service.
Note: Minor variance in summations due to rounding.

As Table 2-9 reflects, the total debt service is expected to grow during the projection period as the Water Department ramps up spending on capital projects. By FY 2028 annual debt service is projected to be approximately $355 million.

2.7 System Flow of Funds and Rate Covenant Test

Table 2-10 presents Arcadis' consolidated projection of the System financial projection for the period FY 2022 to FY 2028. Lines 1 through Line 3 reflect operating revenue consistent with the current rates and charges established as of September 1, 2021. As noted above in Section 2.3.1., Arcadis assumes that billed usage under existing rates will decline at an annual rate of approximately 1.25 percent. As higher than typical revenue increases are expected beginning in FY 2024, Arcadis assumes that billed usage will decrease at an annual rate of 2.25 percent for FY 2024 and FY 2025, and then at an annual rate of 2.0 percent for FY 2026 through FY 2028.

Lines 4 through 10 reflect projected increases in service revenue for FY 2023 through FY 2028 to meet O&M, debt service, and Capital Account deposit requirements, plus provide additional coverage per the Rate Covenant and financial targets established during prior rate proceedings as noted above. The revenue increase for FY 2023 has already been established during the most recent rate proceeding. This increase is subject to a potential downward adjustment as described above during a Special Rate Reconciliation proceeding in calendar year 2022. For purposes of this financial projection, Arcadis assumes the Water Department receives the full revenue impact from the 5.89 percent increase. Should the Rate Board determine a lower revenue increase amount, the revenue increase projections for FY 2024 through FY 2028 shown in Table 2-10 would likely need to be increased to recover the reduced amount.

Arcadis notes that the Water Department has drawn down its Rate Stabilization Fund below its target of $135 million to $124.6 million. It also estimates that additional Rate Stabilization Fund draws will be used in FY 2022 and FY 2023 where revenue increases have been previously approved by the Rate Board (see Table 2-10, Line 19). As shown, Arcadis assumes the Water Department seeks approval for and implements revenue increases of 11.85 percent and 11.60 percent for FY 2024 and FY 2025, respectively to provide sufficient revenue to meet revenue requirements, achieve financial targets of 1.30 times senior debt service coverage, and return the Rate Stabilization Fund to a level of $135 million. Revenue increases beyond FY 2025 are estimated to meet projected revenue requirements and maintain these two key financial targets. As the Water Department begins to implement these revenue increases over the projection period, it should monitor for impacts to customer usage and make adjustments as necessary to meet annual revenue targets.

Line 12 presents other operating revenue related items such as permit fees, interest and penalty revenue, and other miscellaneous items. It also includes revenue offsets related to the Water Department's TAP program noted above. Lines 13 and 14 reflect nonoperating revenue including interest income and any transfers of excess funds from the Debt Reserve Account to the Revenue Fund per the General Ordinance. There are currently excess funds in the Debt Reserve Account, and based on discussions with the Water Department, Arcadis assumes that a $5 million transfer to the Revenue Fund will be made during FY 2022 only (Line 14). Total Revenue for the projection period is seen on Line 15 and is projected to grow from approximately $744 million in FY 2022 to $1.1 billion by FY 2028.

The Total Revenue is used to meet O&M expenses (Lines 16 through 18) and results in Net Revenue (Line 20) available for meeting debt service requirements. As is seen on Line 19, Net Revenue is projected to be adjusted by transfers to and from the Rate Stabilization Fund during the projection period. In FY 2022 and FY 2023 it is assumed that the Water Department will draw down its Rate Stabilization Fund to provide additional funds for capital projects. Beyond the already established revenue increase of 5.89 percent in FY 2023, it is assumed the Water Department will pursue additional revenue increases sufficient to replenish the Rate Stabilization Fund and achieve its Rate Board approved reserve target of a combined $150 million for the Rate Stabilization Fund and Residual Fund by FY 2025.

Net Revenue is used to meet senior debt service requirements (Line 26), any transfers to the Debt Reserve Account (Line 27), subordinate debt service requirements (Line 30), and the Capital Account Deposit Amount seen on Line 33. Line 34 reflects the positive remaining cash amount that is transferred to the Residual Fund.

Lines 35 through 37 present the results of the Rate Covenant coverage tests noted above. The results show that Net Revenues, including Rate Stabilization Fund transfers to and from the Revenue Fund, provide coverage on senior lien debt service that is approximately equal to or greater than 1.20. The Net Revenues, including any Rate Stabilization Fund transfers, provide coverage on senior and subordinate debt service, and the Capital Account Deposit that is greater than 1.00. Finally, Net Revenues, excluding any Rate Stabilization Fund transfers, provide coverage on senior lien debt service that is greater than 0.90.

Table 2-10 shows the Water Department's projected revenues, including the required service revenue increases seen on Lines 4 through 10, are adequate to meet the Rate Covenant requirements of the General Ordinance. The Water Department has set a target coverage ratio for its senior debt service of 1.30 that is beyond the General Ordinance Rate Covenant of 1.20, and it is anticipated that revenue increases will be pursued to achieve this in FY 2024. Achieving this target debt service coverage ratio will provide positive, end of year balances for the Residual Fund that can ultimately be transferred to the Construction Fund to fund a greater portion of the Water Department's annual capital projects.

As of the date of this Report, the Water Department is in the process of returning operations to a pre-Pandemic platform, which includes plans for office-located employees working onsite for at least three days a week. It is noted that billed usage and collected revenue have improved since the stay-at-home restrictions and economic impact of calendar year 2020. The stay-at-home restrictions are no longer in place; however, the Pandemic is continuing and there is continued risk that new COVID-19 variants could disrupt economic conditions or result in restrictions on public gatherings that could negatively impact financial performance. Arcadis has made reasonable assumptions as to projected revenue, including that billings, usage, and payment patterns will gradually improve to pre-Pandemic levels by FY 2024. As there is still uncertainty in the current environment, actual results may be different than the projections in this Report. Arcadis assumes that if the impact of the Pandemic results in lower collected revenue than projected herein, the Water Department will take the necessary steps to adjust operating expenses, delay capital improvements, or increase rates and charges to ensure that the Rate Covenant requirements of the General Ordinance are met and that critical maintenance and improvements to the System are still completed.

Table 2-10. Projected System Flow of Funds ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
	OPERATING REVENUE							
1	Water Service Revenue	273,000	272,184	267,978	262,967	258,613	254,346	250,164
2	Wastewater Service Revenue	451,503	451,898	448,765	444,286	440,319	436,421	432,592
3	Total Service Revenue - Existing Rates	724,503	724,082	716,743	707,253	698,932	690,767	682,756
	Additional Revenue Required							
	Year / Percent Increase / Initial Increase % of Year Effective							
4	FY 2023 [1] 5.89% 83.3%		35,540	42,216	41,657	41,167	40,686	40,214
5	FY 2024 11.85% 83.3%			74,947	88,746	87,702	86,677	85,672
6	FY 2025 11.60% 83.3%				80,973	96,025	94,903	93,802
7	FY 2026 7.60% 83.3%					58,509	69,391	68,586
8	FY 2027 7.50% 83.3%						61,402	72,827
9	FY 2028 6.20% 83.3%							53,933
10	Total Additional Service Revenue Required	0	35,540	117,163	211,376	283,403	353,059	415,034
11	Total System Service Revenue	724,503	759,622	833,907	918,630	982,334	1,043,826	1,097,790
	Other Income							
12	Other Operating Revenue	11,820	14,894	17,303	16,676	16,011	15,307	14,560
13	Interest Income	2,899	2,771	2,746	2,926	3,096	3,096	3,056
14	Transfer From Debt Reserve Account	5,000	0	0	0	0	0	0
15	**Total Revenues**	**744,223**	**777,287**	**853,955**	**938,231**	**1,001,441**	**1,062,228**	**1,115,406**
	OPERATING EXPENSES							
16	Water and Wastewater Operations	(335,626)	(352,604)	(371,149)	(382,986)	(394,644)	(407,106)	(420,007)
17	Direct Interdepartmental Charges	(186,853)	(195,659)	(202,140)	(208,990)	(216,233)	(223,613)	(231,299)
18	**Total Operating Expenses**	**(522,480)**	**(548,263)**	**(573,289)**	**(591,976)**	**(610,877)**	**(630,719)**	**(651,306)**
	NET REVENUES							
19	Transfer From/(To) Rate Stabilization Fund	10,661	15,000	(10,000)	(26,000)	(8,000)	8,000	0
20	**Net Revenues (L15+L18+L19)**	**232,404**	**244,024**	**270,666**	**320,255**	**382,565**	**439,509**	**464,101**
	DEBT SERVICE							
	Senior Debt Service							
21	Outstanding Revenue Bonds	(166,384)	(172,558)	(159,772)	(159,907)	(160,906)	(160,940)	(146,432)
22	Outstanding Pennvest Parity Loans	(10,674)	(10,854)	(11,164)	(13,468)	(15,377)	(16,420)	(16,575)
23	Projected Future Revenue Bonds	0	(7,784)	(36,031)	(70,152)	(109,165)	(149,745)	(181,305)
24	Projected Future Pennvest Parity Loans	0	(119)	(540)	(1,978)	(6,967)	(9,287)	(10,933)
25	Commercial Paper Interest	(4)	(76)	(89)	(64)	(51)	(52)	(15)
26	Total Senior Debt Service	(177,062)	(191,392)	(207,595)	(245,569)	(292,467)	(336,443)	(355,260)
27	Transfer to Debt Reserve Account	0	0	0	0	0	0	0
	Subordinate Debt Service							
28	Outstanding General Obligation Bonds	0	0	0	0	0	0	0
29	Pennvest Subordinate Bonds	0	0	0	0	0	0	0
30	Total Subordinate Debt Service (Ln 28+Ln 29)	0	0	0	0	0	0	0
31	Transfer to Escrow	0	0	0	0	0	0	0
32	Total Debt Service + Transfers (Ln 26+Ln 27+Ln 30+Ln 31)	(177,062)	(191,392)	(207,595)	(245,569)	(292,467)	(336,443)	(355,260)
33	Capital Account Deposit	(29,781)	(31,866)	(34,096)	(36,483)	(39,037)	(41,769)	(44,693)
34	**Net For Transfer to Residual Fund (Ln 20+Ln 32+Ln 33)**	**25,561**	**20,767**	**28,975**	**38,203**	**51,061**	**61,297**	**64,147**
35	Senior Debt Service Coverage - 1.20X (Ln 20 / Ln 26)	1.31	1.27	1.30	1.30	1.30	1.30	1.30
36	Total Payments Coverage - 1.00X (Ln 20 / (Ln 26+Ln 27+Ln 30+Ln 33))	1.12	1.09	1.11	1.13	1.15	1.16	1.16
37	90% Test Coverage - 0.90X (Ln 20 - Ln 19) / Ln 26	1.25	1.19	1.35	1.41	1.33	1.28	1.30

[1] **Subject to special rate reconciliation proceeding to be initiated in FY 2022.**
Note: Minor variance in summations due to rounding.

2.7.1 Reserve Fund Balances

This section presents the projected flow of funds for the Residual Fund, Rate Stabilization Fund, and Debt Reserve Account. In general, the Residual and Rate Stabilization Funds are available to meet the cash needs of the Water Department. The Rate Stabilization Fund can transfer or receive funds from the Revenue Fund at the direction of the Water Commissioner. The Residual Fund can be used per the

General Ordinance to generally pay operating expenses; fund transfers to any other account established by the General Ordinance (excluding the Revenue and Rate Stabilization Funds); pay principal and interest on senior and subordinate debt service; pay amounts due under capitalized leases or other similar obligations; and fund a transfer to the City's General Fund up to a maximum, in any Fiscal Year, of $4,994,000. The Debt Reserve Account is generally restricted to provide funds in the event the Water Department is not able to meet a debt service payment that is due.

2.7.1.1 Residual Fund

Table 2-11, Lines 1 through 8 presents the flow of funds for the Residual Fund. The remaining cash flow from the Revenue Fund is deposited into the Residual Fund as shown on Line 3. This annual deposit combined with beginning balances and interest income is projected to be used for several purposes including a transfer to the Construction Fund (Line 5) to fund a portion of the Water Department's capital projects. As seen on Line 6, a transfer is also made to the City's General Fund in accordance with Section 4.12 (viii) of the General Ordinance which states that a transfer in an amount not to exceed the lower of A) all Net Reserve Earnings or B) $4,994,000. Net Reserve Earnings is the amount of interest earnings earned on funds deposited in the Debt Reserve Account. After these transfers, the projected ending balance for the Residual Fund is approximately $15 million.

2.7.1.2 Rate Stabilization Fund

Table 2-11, Lines 9 through 14 presents the flow of funds for the Rate Stabilization Fund. The Rate Stabilization Fund provides the Water Department with reserve cash funds to mitigate the impact of necessary revenue increases and ensure adequate coverage ratios. Transfers between the Rate Stabilization Fund and Revenue Fund are made at the direction of the Water Commissioner. As is seen, the beginning of FY 2022 balance is less than $135 million due to recent use of this reserve during the Pandemic. it is projected that transfers will be made to and from the Rate Stabilization Fund during the projection period to supplement revenue and return and maintain the end of year balance at the target of $135 million.

It is projected that the Water Department will transfer funds to the Revenue Fund in FY 2022 and FY 2023 to supplement revenue and provide for continued end of year transfers to the Residual Fund and then to the Construction Fund for capital projects. As the projection period progresses, it is estimated that the Water Department will pursue and implement revenue increases resulting in additional revenue that will return the Rate Stabilization Fund to a target balance of approximately $135 million by the end of FY 2025.

Table 2-11. Flow of Funds for Residual Fund, Rate Stabilization Fund, and Debt Reserve Account ($1,000s)

Line No.	Description	2022	2023	2024	2025	2026	2027	2028
	RESIDUAL FUND							
1	**Beginning of Year Balance**	**16,305**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**
2	Interest Income	157	150	150	150	150	150	150
	Transfers In							
3	From Revenue Fund	25,561	20,767	28,975	38,203	51,061	61,297	64,147
4	From Debt Reserve Account	1,901	2,005	2,290	2,638	3,047	3,359	3,587
	Transfers Out							
5	To Construction Fund	(27,022)	(20,917)	(29,125)	(38,353)	(51,211)	(61,447)	(64,297)
6	To City General Fund	(1,901)	(2,005)	(2,290)	(2,638)	(3,047)	(3,359)	(3,587)
7	To Debt Reserve Account	0	0	0	0	0	0	0
8	**End of Year Balance**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**	**15,000**
	RATE STABILIZATION FUND							
9	**Beginning of Year Balance**	**124,661**	**114,000**	**99,000**	**109,000**	**135,000**	**143,000**	**135,000**
10	Interest Income	1,193	1,065	1,040	1,220	1,390	1,390	1,350
	Transfers In							
11	From Revenue Fund	0	0	10,000	26,000	8,000	0	0
	Transfers Out							
12	To Revenue Fund - Transfer	(10,661)	(15,000)	0	0	0	(8,000)	0
13	To Revenue Fund - Interest	(1,193)	(1,065)	(1,040)	(1,220)	(1,390)	(1,390)	(1,350)
14	**End of Year Balance**	**114,000**	**99,000**	**109,000**	**135,000**	**143,000**	**135,000**	**135,000**
	DEBT RESERVE ACCOUNT							
15	Beginning of Year Balance	**192,595**	**187,595**	**213,362**	**244,669**	**282,870**	**326,588**	**345,197**
16	Interest Income	1,901	2,005	2,290	2,638	3,047	3,359	3,587
	Transfers In							
17	From Bond Proceeds	0	25,767	31,306	38,201	43,718	18,609	27,003
18	From Revenue Fund	0	0	0	0	0	0	0
	Transfers Out							
19	To Revenue Fund - Excess Funds	(5,000)	0	0	0	0	0	0
20	To Residual Fund - Interest	(1,901)	(2,005)	(2,290)	(2,638)	(3,047)	(3,359)	(3,587)
21	**End of Year Balance**	**187,595**	**213,362**	**244,669**	**282,870**	**326,588**	**345,197**	**372,200**

2.7.1.3 Debt Reserve Account

The Debt Reserve Account of the Sinking Fund is established per the General Ordinance to maintain a reserve equal to the Debt Reserve Requirement. The Debt Reserve Requirement is the greatest amount of Debt Service Requirements payable in any one Fiscal Year, or generally the maximum annual senior debt service. Table 2-11 presents the projected flow of funds for the Debt Reserve Account. As shown, at the beginning of FY 2022 there was approximately $192 million in the Debt Reserve Account. This amount is currently sufficient to meet the Debt Reserve Requirement of approximately $183 million. Arcadis estimates that the Water Department will transfer $5 million of this excess reserve to the Revenue Fund in FY 2022. Based on discussions with the Water Department, it is expected that this reserve will be maintained as the abovementioned Pennvest Loans are closed and the CP Program is implemented. Arcadis projects that the next increase in the Debt Reserve Account will be needed upon the issuance of the Series 2022 (FY 2023) revenue bond issuance. Arcadis assumes that this increase will be met from additional revenue bond proceeds from this issuance. As also shown on Line 17, additional increases to

the Debt Reserve Account are expected to be made with each projected revenue bond issuance to maintain the projected Debt Reserve Requirement, or maximum annual senior debt service which includes CP Program interest payments. Interest earnings on amounts deposited in the Debt Reserve Account are credited to this account until it is fully funded, and then transferred to the Residual Fund for subsequent transfer to the City's General Fund in accordance with the General Ordinance, as seen on Line 20.

The Twenty-First Supplemental Ordinance included certain "Springing Amendments" that are set to take effect upon the consent of the holders of at least 67% of Water and Wastewater Revenue Bonds outstanding. One of these amendments includes a change that will no longer allow the Water Department to transfer excess funds from the Debt Reserve Account to the Revenue Fund. Once the 67 percent threshold of consent is reached, the Water Department will be allowed to transfer any excess funds in the Debt Reserve Account to the Sinking Fund to pay Debt Service Requirements, or if excess funds do not constitute tax-exempt bond proceeds, to the Residual Fund for the purposes thereof. The Water Department indicates that the consent of the holders of at least 67% of Water and Wastewater Revenue Bonds outstanding will likely be achieved during the next revenue bond issuance. Therefore, beyond FY 2022, Line 19 shows no projected transfers to the Revenue Fund.

2.8 Conclusions

Arcadis has performed an analysis of the estimated future financial operations of the Water Department. As outlined in this Section and subject to the assumptions outlined herein, it is Arcadis' opinion that:

1. The Water Department plans to increase capital spending significantly through FY 2028, and regular bond issuances are anticipated to fund a portion of the capital expenditures. This will require consistent revenue increases to the Water Department's service charges to meet revenue requirements, target debt service coverage levels, and reserve fund balances. At the time of this Report, the Water Department has drawn its combined Residual Fund and Rate Stabilization Fund reserve levels below its established target of $150 million. The revenue increases in FY 2024 and FY 2025 are relatively higher than recent historical revenue increases, however, they are necessary to implement the CIP as projected, achieve the targeted senior debt service coverage of 1.30, and return and maintain the combined Rate Stabilization Fund and Residual Fund reserves at or above $150 million over the projection period.
2. The System will yield pledged Project Revenues, including the projected increases in service revenue indicated in the Report, over the amortization periods of the water and wastewater revenue bonds anticipated to be issued in FY 2023 and FY 2024, sufficient to meet the projected payments or deposit requirements of:
    - all projected operation, maintenance, repair and replacement expenses of the System;
    - all reserve funds required to be established out of such Project Revenues; and
    - the principal or redemption price of and interest on anticipated Bonds, as the same become due and payable, for which the Project Revenues are pledged.
3. The Net Revenues are currently sufficient to comply with the Rate Covenant and are projected to be sufficient, including the projected increases in service revenue indicated in the Report, to comply with the Rate Covenant for each of the two Fiscal Years following the Fiscal Year in which the anticipated FY 2023 and FY 2024 revenue bonds are issued, including the two Fiscal Years (FY 2024 and FY

2025) following the Fiscal Year up to which interest has been capitalized (FY 2023) on the Series 2020A revenue bonds. This includes the requirement to yield Net Revenues that are at least:

- 1.20 times the Debt Service Requirements for such Fiscal Year (excluding Debt Service Requirements in respect of Subordinated Bonds); and
- 1.00 times (A) the Debt Service Requirements for such Fiscal Year (including Debt Service Requirements in respect of Subordinated Bonds); (B) amounts required to be deposited into the Debt Reserve Account during such Fiscal Year; (C) the principal or redemption price of and interest on General Obligation Bonds payable during such Fiscal Year; (D) debt service requirements on Interim Debt payable during such Fiscal Year; and (E) the Capital Account Deposit Amount for such Fiscal Year (less any amounts transferred from the Residual Fund to the Capital Account during such Fiscal Year); and
- 0.90 times Debt Service Requirements for such Fiscal Year (excluding Debt Service Requirements in respect of Subordinated Bonds); provided that, for purposes of this clause Net Revenues shall be calculated to exclude any amounts transferred from the Rate Stabilization Fund to the Revenue Fund.

4. The FY 2023 revenue increase is subject to reduction per the recent rate proceeding during a Special Rate Reconciliation Proceeding to be initiated by the Water Department on or before March 1, 2022. The financial projection in this Report assumes the full revenue increase is maintained for the projection period, which would provide a baseline of additional revenue to support known, future capital and operating costs while maintaining targeted reserve fund balances. Should any significant reduction to the FY 2023 revenue increase result from the Special Rate Reconciliation Proceeding, it is more likely that future, higher revenue increases will be necessary assuming the Water Department's operating and capital expenses remain as projected. The Water Department will need to assess the impact of any reduction to the FY 2023 revenue increase and make appropriate financial adjustments as necessary to achieve the projected results reflected in this Report.
5. The Water Department is currently managing the System amidst the Pandemic. Arcadis has provided a financial projection as part of this Report that includes assumptions with respect to the impact of the Pandemic on collected revenue and financial performance. While we believe these assumptions are reasonable for this Report, it is noted that there is still uncertainty with respect to the Pandemic that could result in negative financial performance, and actual results may differ from the projection in this Report. Should the impact of the Pandemic result in financial performance that is materially lower than projected herein, it is assumed the Water Department will take the necessary actions to reduce operating expenses, delay capital improvements, or increase rates and charges as necessary to meet the General Ordinance Rate Covenant and provide critical operation and maintenance of the System.

3 WATER DEPARTMENT ORGANIZATION

3.1 Organizational Structure

The City of Philadelphia (City) owns and manages the System via the Water Department. The Water Department is an enterprise fund utility that relies on service revenue generated from customer rates, fees, and charges. The main functions of the Water Department are outlined in Article V, Chapter 8 of the Philadelphia Home Rule Charter, and its general functions and focus areas include:

- Operation of the City's water supply system, as well as construction, maintenance, repair and improvements to City water supply facilities, including fire hydrants and water meters;
- Preparation of plans and estimates looking towards the acquisition by the City of new and better sources of water supply, as well as the investigation and adoption of methods for improving the quality of the water supply;
- Operation, maintenance, repair and improvement of the City's sewage system and sewage disposal plants, as well as the acquisition, design and construction of additional sewage disposal plants and sewage facilities;
- Fix and regulate rates and charges for providing water and sewer service; and
- Enter into contracts for supplying water and sewer service to users outside of the City.

In addition to these core functions, the Water Department performs detailed financial management and accounting, and other administrative functions to properly manage the System.

The Water Department is structured into multiple operating divisions that focus on operations, planning and engineering, finance, public affairs, and other support and administrative functions that are discussed in subsequent sections of this Report. The Water Commissioner, who is appointed by the Mayor, leads the Water Department. Mr. Randy Hayman has been the Water Commissioner since June 2019. He is an experienced water industry professional with a background in utility leadership, including ten years as General Counsel for the St. Louis Metropolitan Sewer District and five years as General Counsel for DC Water. His background also includes time with a top-tier environmental law firm.

The Water Commissioner is assisted by an experienced staff of senior managers, including the Deputy Commissioner of Operations; Deputy Commissioner of Finance; Deputy Commissioner of Planning and Environmental Services; Deputy Commissioner of Administration and Human Resources; Deputy Commissioner of Communications and Engagement; and Engineering and Construction General Manager. These senior managers are experienced in their particular field of expertise and assist the Water Commissioner with management of critical utility functions. Other key managers include the Information Services & Technology (IS&T) Director and General Counsel. There is also a Director of Policy and Strategy leadership position that is currently vacant.

The Water Department provided Arcadis with its overall organizational structure which is seen below in Figure 3-1. It provides the key divisions and operating units, as well as management and staff responsible for each divison or unit. Based on our discussions with management, and Arcadis' experience with other well-managed water and wastewater utilities, the Water Department's organizational structure is

appropriately focused to manage its key functions and responsibilities, and is capably led by a well-qualified and professional staff.

The City also supports the Water Department via several other City departments. The Water Revenue Bureau (WRB), which is a division within the City's Revenue Department, is responsible for billing, collection, and customer accounting for the water and wastewater systems. The WRB and Water Department cooperate to provide customer service and support, as well as enforcement of payment collection from delinquent customer accounts. The WRB, reporting to the Revenue Commissioner, is ultimately the responsibility of the City of Philadelphia, Director of Finance. The City Controller is responsible for the Water Department's audit functions, and the City Solicitor's office has a Divisional Deputy City Solicitor that is assigned directly to the Water Department. As noted on the Water Department's organizational chart, the IS&T Director reports to the Water Commissioner, but also has dual reporting responsibility to the City's Office of Innovation & Technology (OIT).

Data provided by the Water Department as of September 1, 2021 indicates that the Water Department has a total of 2,109 employees. There are two labor unions that represent a portion of employees, including the American Federation of State, County, and Municipal Employees Union District Councils 33 and 47. These two Councils represent approximately 1,482 and 411 employees, respectively. The other 216 employees are management, supervisory, senior engineering, or part-time employees that are not eligible for union membership. The overall vacancy rate for the Water Department at the end of FY 2020 and FY 2021 was approximately 12.4 percent and 15.3 percent, respectively. The Water Department has indicated that the vacancy rate has continued to increase in FY 2022. This increase in the percentage of vacancies likely reflects the impact of the Pandemic, as industries across the U.S. have experienced challenges to hiring qualified workers. Water Department interviewees also indicate that it has been relatively more difficult to find qualified and skilled workers and navigate the City's overall hiring process. The Water Department targets an overall vacancy rate of less than 15 percent. The Water Department will need continued focus in this area to achieve its vacancy rate target by attracting qualified and skilled workers to replace personnel losses related to regular turnover and retirements.

The shortage of qualified staff may potentially be exacerbated as vaccine mandates by the City may result in termination of certain Water Department staff that do not comply with the City's mandate. Initially, the City set a December 1, 2021 deadline for certain non-union workers to be vaccinated. At that point, any of these workers that choose not to be vaccinated would face termination as of December 15, 2021.

On November 19, 2021 the City announced that all other workers, including union employees, are required to be vaccinated by January 14, 2022. The vaccine mandate adds uncertainty to staffing levels that will be available to perform operation and maintenance tasks beyond the January 2022 timeframe. The Water Department will need to monitor the impact of the vaccine mandate and backfill or adjust staffing as necessary to complete ongoing critical tasks.

In addition to the Water Department direct employees noted above, dedicated support staff for the WRB, IS&T, Law, Finance, and other City departments are funded through the Water Fund, which accounts for the overall costs of the System. The personnel services costs related to these staff are included in the Projected Financial Requirements (Section 2) section of this Report.

Arcadis conducted interviews and corresponded with certain staff from various Water Department divisions from October to December 2021. The following sections provide a general overview for several of the Water Department's key divisions.

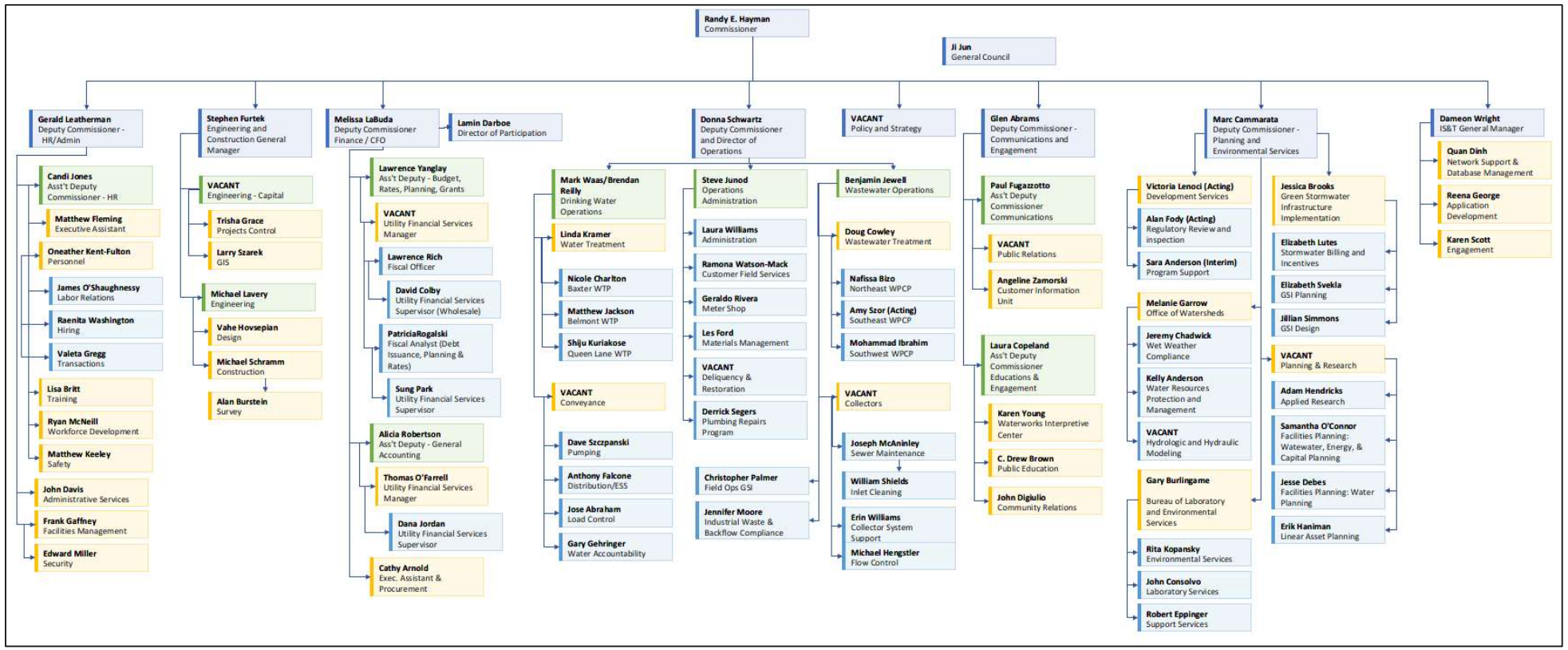

Figure 3-1. Organizational Chart

3.1.1 Operations Division

The Operations Division provides the core O&M functions of the Water Department, including water treatment and delivery; wastewater collection and treatment; stormwater conveyance; and disposal of sewage sludge and residuals remaining from the wastewater and drinking water treatment processes.

The Operations Division is supported by the Planning and Environmental Services Division, and the Engineering and Construction Division to plan, design, and construct System improvements that provide for the efficient and reliable delivery of services. Members of this division participate in industry Associations such as the American Water Works Association and Water Environment Federation. The Operations Division is also responsible for complying with key regulatory permits, and thus interacts regularly with the Pennsylvania Department of Environmental Protection (PADEP) and U.S. Environmental Protection Agency (USEPA).

The Deputy Commissioner of Operations reports to the Water Commissioner. This Division is organized into units that focus on the following key areas for the day-to-day operation and maintenance of the systems:

Drinking Water Operations

- Water Treatment – This unit focuses primarily on the operation and management of the Baxter, Belmont, and Queen Lane drinking water treatment plants.
- Water Conveyance – This unit focuses on the pumping and conveyance of drinking water to customers and maintains the water transmission and distribution systems.

Wastewater Operations

- Wastewater Treatment – This unit focuses primarily on the operation and management of the Northeast, Southeast, and Southwest Water Pollution Control Plants (WPCPs). This unit includes a sub-unit for Industrial Waste & Backflow Compliance that focuses on certain water and wastewater customers that must comply with regulations to protect drinking water system quality (regulation of backflow devices) or the operation of the WPCPs (regulation of significant strength industrial customers).
- Collector Systems – This unit focuses on operating and maintaining the collection systems, including sanitary, storm, and combined sewer mains and associated pumping assets. This unit includes a sub-unit for Field Operations Green Stormwater Infrastructure (GSI) that focuses on maintaining GSI so that it remains effective for capturing and retaining runoff during wet weather events.

Operations Administration

Operations Administration focuses on operational and customer facing elements such as field services, meter repair and inspection, customer delinquency and restoration, and the plumbing repair program.

Based on our discussions with staff, there are vacancies that occur on a regular basis in the Operations Division. Similar to other large, U.S. utilities the Water Department experiences difficulties in quickly obtaining qualified replacements. These issues are not unique to the Water Department, and as noted above, the Water Department will need continued focus on its hiring processes to adequately maintain

staffing levels. With the expansion of GSI and shifting from contractor-based maintenance to internal maintenance, staffing levels for this division are anticipated to increase in the future.

As the Pandemic continues the operations division is operating in a similar fashion as it did prior to the Pandemic; however, there are still practices in place to facilitate social distancing of workers. The Water Department has generally been able to stay on track with inspections and maintenance activities, but a backlog of work remains and absence levels remain higher than historical levels.

The Water Department Safety Unit has a COVID-19 coordinator that follows up on potential coronavirus exposure incidents to ensure that any further spread to staff is mitigated through self-quarantine measures. Additional COVID-19 related work policies were developed and are updated regularly. Many planning, design, and administrative staff are working from home. In the past fiscal year (FY 2021), the Southwest WPCP experienced an NPDES permit exceedance in August 2020 due to a wet weather event. Otherwise, the Water Department has been able to maintain regulatory compliance despite the additional demands and challenges encountered with the Pandemic.

3.1.2 Planning and Environmental Services Division

The Planning and Environmental Services Division includes five primary units that are focused on planning to meet short and long-term System needs, while maintaining compliance with applicable regulatory requirements. The five primary units of this division are the Planning and Research Unit; Development Services Unit; Office of Watersheds; Green Stormwater Infrastructure Implementation Unit; and Bureau of Laboratory Services Unit. The Deputy Commissioner of Planning and Environmental Services leads this division and reports directly to the Water Commissioner. The following provides a brief overview of these core units.

3.1.2.1 Planning and Research Unit

This unit focuses on strategic planning around the Water Department's core system areas. The unit is organized to facilitate linear asset planning, facilities planning and greenhouse gas (GHG)/energy management planning. The unit has an integrated research and capital planning unit that facilitates and enables this work.

- Linear Asset Planning Program – There are four groups in this program: sewer planning, flood risk management, distribution system planning, and transmission system planning. This program focuses on horizontal (in ground) linear assets. The program seeks to identify and prioritize projects through assessment of physical conditions (e.g., material type, age, repair history, or flooding history) and assess the risk by combining an estimate of likelihood of failure and the consequence of failure. The goal of which is to maximize the value of the infrastructure investment while achieving the Water Department's level of services goals.
- Facilities Planning Program – This program focuses on the long-range planning efforts for the non-linear assets such as treatment plants and pumping stations. This program has produced the Water Department's Drinking Water Master Plan and is updating the department's Wastewater Master Plan. This program also uses risk governance techniques to prioritize replacement and renewal. The physical condition of an asset as well as the risk and consequence of failure is determined and integrated with capacity needs and future regulatory compliance needs.

- Integrated Planning Program (research, energy and capital planning) – This program provides internal support to the other Planning and Research programs as well as and to the Water Department at large. The Energy group manages the Water Department's energy accounts, participates in the City's energy procurement process, reports the Water Department's GHG footprint and develops renewable energy projects. This group is charged with monitoring the Utility Wide Strategic Energy Plan. The Research group conducts research into areas to facilitate strategic planning, new processes, and new ideas. The Capital Planning group monitors the flow of capital projects and facilitates the systematic review of all capital projects above $2.0 million. The process involves the establishment of a core review committee to determine and report on the most viable options for capital investments.

3.1.2.2 Development Services Unit

The Development Services Unit (DSU) is a new unit which merges Utility Planning Review from Construction and Engineering, Stormwater Plan Review, and Post-Construction Stormwater Enforcement as well as related support groups into a single unit to better serve private development project needs. The goal of the DSU is to be responsive to development projects and support the development community while maintaining clear regulations and requirements to ensure protection of the Water Department operations and infrastructure. Some of the unit's initiatives include publishing clear service-level goals for all development reviews, conducting outreach and releasing comprehensive guidance so that processes are clear and accessible, working with other Water Department groups to provide coordinated responses to development projects, and implementing the Water Department's Stormwater Regulations and other regulatory requirements through the review, inspection, and enforcement of development sites. There are two primary functions/programs within the unit:

- Regulatory Review and Inspection: The Regulatory Review and Inspection program is responsible for the implementation of the Water Department's regulations as it relates to development project compliance. Staff in this program are responsible to review engineering plans and conduct inspections to ensure that stormwater management practices are correctly designed, installed, and maintained on-site, and that proposed water and sewer connections to Water Department infrastructure are completed in accordance with requirements.
- Program Support: Program Support is the policy and administrative arm of the DSU, responsible for overseeing a variety of functions including regulatory enhancements, engineering design improvements, data management, and enforcement of active and post-construction projects.

3.1.2.3 Office of Watersheds

The Office of Watersheds Unit is focused on several planning areas, including the implementation of the Long-Term Control Plan Update (LTCPU) in response to the Water Department's COA with PADEP. There are three primary programs described below:

- Wet Weather Compliance – This program focuses on implementing the LTCPU to meet the requirements of the COA, as well as maintaining compliance with the Water Department's MS4 permit and other Clean Water Act obligations. This program manages and tracks progress toward NPDES permit and COA obligations such as greened acre targets. Primary responsibilities include

the collection and analysis of monitoring data from constructed green stormwater infrastructure systems.

- Water Resources Modeling – To achieve compliance with the COA, the Water Department undertakes system improvements to reduce the impact of wet weather runoff on its system and local waterways. This program utilizes hydraulic and hydrologic models to understand the impact that improvements have on reducing runoff and pollutant loadings to local waterways.
- Water Resources Protection and Planning – This program focuses on several planning elements related to improving water quality and quantity at the basin scale and throughout local waterways. A key focus area in recent years has been on the issue of climate change, water supply management, evolving regulatory compliance efforts, and emerging contaminants (e.g., Per- and Polyfluoroalkyl Substances (PFAS)). This program focuses on understanding the actual and potential risks related to changing watershed conditions, climate change and their impacts on the Water Department's assets and operations.

3.1.2.4 Green Stormwater Infrastructure Implementation Unit

The Water Department's COA includes greened acre implementation targets that must be met over the 25-year term of the COA. The GSI Implementation Unit is responsible for coordinating and implementing greened acres that will capture and mitigate the amount of runoff that enters the collector system and ultimately impacts the quality of local waterways. There are four primary functions/programs within the GSI Implementation Unit:

- Stormwater Billing and Incentives – The Stormwater Billing and Incentives Program is responsible for the daily maintenance of the Water Department's stormwater billing database, ensuring the generation of accurate stormwater charges for all Water Department customers, and for overseeing all aspects of grant-funded stormwater retrofit projects, including project origination, design review and project close-out.
- GSI Planning – The GSI Planning Program is primarily responsible for analyzing and identifying locations for GSI that will become public infrastructure owned by the Water Department. In addition to identifying potential public projects through district planning efforts, the team is also responsible for developing planning strategies for expanding success with partners, furthering the impact of private incentives, and coordinating associated policy/legal needs.
- GSI Design – The Design Program's mission is to advance the ability of the Water Department to design and build GSI and ecological restoration/riparian asset protection projects. The program's primary responsibilities are developing construction documents for asset protection projects, developing resources and standards, and providing technical support to planning and construction groups.

3.1.2.5 Bureau of Laboratory Services

The Bureau of Laboratory Services (BLS) provides a variety of analytical services to support the Water Department's water quality requirements and environmental research initiatives. The Water Department provides drinking water, wastewater, and stormwater services. Each of these services requires regular

monitoring to ensure that the Water Department maintains compliance with applicable regulatory requirements. Additionally, the BLS provides analytical services to help the Water Department develop solutions that will allow it to more effectively and efficiently treat water so as to improve the quality of drinking water delivered to customers, as well as the quality of wastewater returned to the environment. The BLS manages a state-accredited laboratory, as well as process control laboratories at the Water Department's three wastewater treatment plants.

BLS is organized into the following sub-units which include the Administration; Quality Assurance & Support Services; Water Quality and Control; Scientific and Regulatory Affairs; Wastewater Laboratories; Environmental Laboratories; Watershed Sciences; and Materials Testing and Certification. The following provides an overview of BLS responsibilities and initiatives:

- Testing – BLS conducts regular testing throughout its water, wastewater and stormwater systems. This includes process testing to ensure treatment processes are working effectively, as well as compliance testing to ensure that water quality meets applicable regulatory requirements. In addition to the testing at water and wastewater treatment plants, BLS conducts sampling of the drinking water distribution system to ensure that water quality remains high. It also conducts testing of local waterways as part of the implementation of Green City, Clean Waters program that seeks to reduce instances of combined sewer overflows and improve regional water quality.
- Materials Engineering Laboratory – BLS conducts testing of materials and equipment used by the Water Department. An example of this is the compressive strength testing of concrete cylinder samples on certain Water Department projects to ensure that the concrete pour is in compliance with construction specifications.
- Drinking Water Quality – BLS' goal remains to obtain the collection of approximately 2,500 drinking water samples each month from the treatment plants and distribution system. The Pandemic resulted in reductions in the number of samples, as well as revisions to several sampling locations which were approved by PADEP. BLS maintains 85 routine sample locations (some of which have had reduced usage during the Pandemic), and 40 real-time monitoring panels that are part of the Water Department's Surveillance and Response System. BLS also monitors customer water quality complaints and responds to these instances to ensure water quality remains high.
- Interagency Cooperation – BLS has been an active participant in the review and development process for regulatory changes contemplated by USEPA and PADEP. An example of this is its participation with USEPA in developing proposed changes to the Long-Term Lead and Copper Rule. BLS also recently assisted PADEP with the development of the Disinfection Requirements Rule. The Lead and Copper Rule changes are anticipated to have an impact on BLS and the Water Department going forward.

3.1.3 Engineering and Construction Division

The Engineering and Construction Division is responsible for effectively designing and constructing System improvements per the Water Department's CIP. This includes working closely with the Operations Division and the Planning and Environmental Services Division to implement project solutions that provide safe and reliable service to the Water Department's customers. The primary units of this division

include the Design Branch, Projects Control Unit, and the Construction Branch. The following provides a brief description of these units.

- Design Branch – The Design Branch performs all engineering functions related to the design of the Water Department's capital projects. Generally, project concepts are developed by the Operations Division or Planning and Environmental Services Division. The Design Branch works closely with these divisions to develop capital projects that can be implemented and included on the Water Department's overall CIP. Other significant responsibilities of the Design Branch include providing input to operations and maintenance staff; reviewing shop drawings; providing engineering expertise to the Operations Division during emergencies; and coordinating to ensure the use of Water Department engineering standards by outside consultants or developers.
- Projects Control Unit – The Projects Control Unit manages, coordinates, and tracks the Water Department's CIP. This includes prioritizing projects within the CIP and ensuring that projects are properly evaluated and budgeted to result in successful completion. This unit coordinates with the Planning and Research Unit to evaluate larger, more complex projects to ensure that they are vetted by the various stakeholders within the Water Department. Other responsibilities for this unit include responding to one-call requests, inspection of connections to the sewer system, compliance with Act 537 requirements, as well as management of the Water Department's Geographical Information System (GIS) that stores much of the Water Department's engineering records.
- Construction Branch – The Construction Branch works to ensure that capital projects are successfully implemented according to Water Department specifications. This includes monitoring contractors, evaluating change orders, handling payment requests from contractors, and preparation of as-built drawings. The Construction Branch includes the Survey group, which provides site surveying assistance for the various Water Department projects.

3.1.4 Finance Division

The Finance Division is responsible for the Water Department's budgeting and accounting functions, procurement, and also leads the obtainment of capital financing for the CIP and the setting of rates and charges for customers. The Deputy Commissioner of Finance leads this division and reports directly to the Water Commissioner.

The following provides key aspects of the Finance Division's activities:

- Capital Management – The Water Department's capital needs are substantial, and the Finance Division leads debt issuance activities to obtain the necessary capital financing. Working with other City departments and its external team of advisors, the Finance Division closed the Water & Wastewater Series 2021C and 2021D in the first quarter of FY 2022.
- Rates and Charges – The Finance Division leads the Water Department's rate filings to the Philadelphia Water, Sewer, and Storm Water Rate Board. This includes assembling testimony and relevant exhibits documenting the Water Department's request for rate and charges that meet its revenue requirements.
- Disadvantage Business Coordination, Planning and Goals – The Finance Division Deputy Director of Participation collaborates with the City's Office of Economic Opportunity (OEO) to ensure processes

are in place to maintain compliance with the Philadelphia Home Rule Charter, the General Provision of the Philadelphia Code, the Mayor's Executive Order EO_1-21, and other federal, state, and local laws as it relates to Minority, Women, and Disabled owned business participation and workforce diversity on the Department's contracts.

The Department's Deputy Director of Participation collaborates with project managers within the Department to identify subcontracting opportunities; enforce contract compliance of subcontractor utilization; monitor prime contractor payments to subs; and address any non-compliance complaints from OEO. The Deputy Director of Participation also supports the quarterly and annual participation reporting function, communications regarding economic inclusion, general contract development and vendor outreach program initiatives. The following Table reflects the Water Department's performance with respect to achieving its M/W/DSBE goals:

Table 3-1: Summary of Water Department M/W/DSBE Goals and Results

Fiscal Year	Goal	Results	Total Dollars Committed
2021	33%	38%	$ 63,731,184
2020	33%	35%	$ 87,870,851
2019	30%	33%	$ 71,540,646

Other significant responsibilities for this division include the preparation of annual financial reports; procurement of equipment and services; long-term financial planning; accounts payable processing; and preparation of bills for wholesale customers.

3.1.5 Human Resources and Administration Division

The Human Resources and Administration Division provides administrative and human resources support to the entire Water Department. Key responsibilities of this division include:

- Administering traditional personnel functions with initiatives in manpower and management training.
- Ensuring that personnel recruitment, placement, training, career development and safety programs are consistent with the Water Department's long-term human resources needs and support its diversity and inclusion goals.
- Initiating policy development related to administration and human resources management.
- Ensuring the effective communication of policies and procedures generated by management throughout the Water Department.
- Coordinating labor management initiatives and employee relations programs with the Water Department's long-range operational plans.
- Overseeing facilities management operations for administrative and certain water facilities.

During the ongoing Pandemic, additional responsibilities have included monitoring of COVID-19 cases, overseeing the modification of administrative office space to provide safe distancing between employees, and installation of equipment at larger facilities to enhance safety. Additionally, the Human Resources and Administration Division is helping to implement the vaccine mandate for workers (described above), as well as the City's overall return to work policy. In July of 2021, the City began to set general guidelines for having employees that have been working from home during the Pandemic return to work. The City's general guidelines provided for workers to be at their City positions two days per week and at home three days per week. The guidelines did provide some discretion to departments based on their unique responsibilities. The Water Department has been considering its return-to-work policy in light of the City's guidelines and its day-to-day work responsibilities. The Water Department has determined that it will initiate a six-month pilot policy that has workers report to their onsite workplaces three days per week. The other two days the workers will be allowed to work from home. The policy does provide unit managers the discretion to set the particular days a worker is onsite, and it does allow manager's the discretion to revoke work from home privileges for underperforming staff. The pilot policy is set to begin in January of 2022 and run for six-months. At that point the Water Department will reevaluate how it is working and make any adjustments.

There are five major units that perform the abovementioned responsibilities, including the Personnel, Safety, Training, Administrative Services, and Facilities Management units.

A key responsibility for this division is the filling of vacant positions for the other Water Department divisions and their associated units. To accomplish this, this division works with the City's Office of Human Resources (OHR) to hire new personnel. This includes attracting, vetting, and hiring a well-qualified and diverse workforce. The Water Department conducts outreach events to identify and attract talent, and strives to limit overall vacancies to around 10 percent. As noted above, the end of year vacancy rate for FY 2021 was approximately 15 percent.

The Water Department has been able to hire and fill positions throughout the Pandemic. The Water Department currently notifies the OHR when it intends to fill a position, but is not currently required to obtain OHR approval prior to hiring, which is similar to pre-Pandemic mode of hiring.

The Training Unit manages the Water Department's Apprentice Program. Through this program, the Water Department finds high school students that are interested in technical trades. It then hires them as apprentices where they complete high school and then the required training for their particular trade. Once the required training has been completed, the Water Department hires them on a full-time basis as regular, civil service employees.

The Safety Unit builds training programs and supports Water Department safety committees in their goal to promote a safe work environment. The level of training conducted has decreased since the onset of the Pandemic. This unit has shifted focus to monitoring COVID-19 cases and facilitating safety around successfully working through the Pandemic. As training cannot now be conducted in large groups, the number of events and staff engaged for training has lessened.

The number of paid days lost was provided by the Water Department (Table 3-2) and reflects an increasing trend. Injured Water Department employees are managed in the worker's compensation program via a third-party administrator retained by the City. Given the increasing trend in paid days lost, the Water Department should continue to monitor and proactively work with the City to understand and

implement potential measures to mitigate this trend. The impact of this increasing trend consists of costs related to overtime and worker's compensation that are included in the budget. Additionally, longer-term injured on duty personnel require managers to perform their everyday tasks at a reduced staffing level.

Table 3-2. Paid Days Lost Record

Fiscal Year	Paid Days Lost
2015	2,059
2016	2,117
2017	3,608
2018	4,364
2019	6,844
2020	8,043
2021	8,481

The Administrative Services unit is primarily focused on managing the Water Department's space at Jefferson Tower. This unit recently renovated the fourth floor, which consists of Pandemic-related modifications, as well as a new kitchenette, mother's room, and conference room. This unit is currently renovating restrooms and elevator lobbies. This unit also manages the contracts for office equipment such as copiers, phones, and other miscellaneous office supplies.

The Facilities Management Unit generally focuses on maintaining the Water Department's administrative buildings, including general maintenance activities and maintenance of heating, ventilation, and air conditioning (HVAC) systems. It also plays a role in maintaining certain water system facilities with respect to pump repairs and other general maintenance activities.

3.1.6 Public Affairs Division

The Public Affairs Division develops comprehensive communication strategies and education programs to support the Water Department's outreach efforts to the public. This division engages regularly with the media, advocacy groups, community groups, businesses, and other entities to represent the Water Department's ongoing work and initiatives, as well as to listen and convey public feedback to management. The Public Affairs Division consists of two main functional teams which includes (i) Communications and (ii) Education & Engagement.

Communications

- Customer Information Unit (Call Center)
- Public Relations

Education & Engagement

- Public Education

- Fairmount Waterworks Interpretive Center
- Community Relations

3.1.6.1 Education & Engagement

Educating the public about the various Water Department initiatives is a key focus area for Public Affairs. Public Affairs utilizes several methods for informing the public. This includes forging relationships with community groups, media, schools, and other agencies to provide information on the Water Department's ongoing initiatives, particularly related to the urban watershed and the provision of water, sewer, and stormwater services to City residents and businesses.

Initiatives include creating a strategic planning process for education programs with clear goals and deliverables that align with the broader public and community communications strategy. As part of the broader strategy, the Water Department is in the process of migrating website content from the City IT based phila.gov site to new pages at water.phila.gov, with the goal of enhancing a user's experience with the website content. In addition, the internal intranet websites will be updated across all divisions with new content to improve internal communication following a revised internal communications strategy.

Public Affairs also manages the Fairmount Waterworks Interpretive Center (FWWIC). This venue, which is located adjacent to the historical Fairmount Waterworks, has historically been open to the public providing education on the urban watershed, innovative management techniques, and how people can participate in the promotion of clean watersheds. The FWWIC sustained damaged due to flooding from the remnants of Hurricane Ida in September 2021 and the FWWIC was unable to open and now remains closed indefinitely. FWWIC educators continue to provide robust virtual, online, and exterior site-based programs to schools, home school groups, partners, and community organizations, while closed.

3.1.6.2 Communications

The Water Department's services touch each City resident. Therefore, it is important to communicate and inform customers of the various, ongoing initiatives to improve water quality and overall service. The Digital Team and Creative Team work to provide informative materials and websites that are available for use by the average citizen or for community groups. This includes looking for more creative ways to disseminate information through email, text, and other digital methods. Electronic mail communication and social media campaigns have been designed by the Digital and Creative teams and implemented to educate customers on customer assistance and payment agreement programs, and as a means of reaching people as more customers transition to paperless billing and payment.

The Water Department Public Affairs team assumed responsibility for the combined Water Department and Water Revenue Bureau customer call centers. Call center staff field customer inquiries related to a variety of issues such as billing inquiries; service issues (e.g., flooding or taste and odor); service requests; requests for information on Water Department initiatives; or other similar requests. Public Affairs works to cross train staff to be able to handle all types of issues. The call center tracks key service metrics such as number of calls received; call abandonment rate; average wait time; and average call duration. In recent years the call center has fielded approximately 150,000 calls per year.

The call center transitioned to a remote work environment in 2020 due to the Pandemic. The call center is functioning in a hybrid mode, which includes an alternating schedule where one-half of the call center staff work onsite and the other one-half work remotely. The Deputy Commissioner of Communications and Engagement notes that this hybrid mode has been effective.

3.1.7 Information Services & Technology

The Information Services & Technology Unit is dedicated to serving the Water Department, but organizationally is a part of the City's Office of Innovation and Technology. As of the FY 2022 Budget, there are approximately 86 budgeted positions dedicated to serving the Water Department operations through the Enterprise Services, Unified Communications, and Departmental Services programs. There are another 25 budgeted positions that support elements of the Water Revenue Bureau and Law programs that are funded by the Water Fund.

IS&T is led by the IT Director who reports directly to OIT, but who is located and works closely with the Water Commissioner to coordinate the technology needs for business and administrative functions of the Water Department. IS&T does not manage the operational or engineering technology functions of the Water Department such as SCADA and GIS.

3.1.7.1 Key IS&T Units

IS&T consists of three key units. The following provides a brief description of their focus areas:

- System Team: This team is responsible for the operations, maintenance and planning activities associated with the physical network and server environment, database management and new technologies for the Water Departments business and administrative systems.
- Business Team: This team focuses on IS&T portfolio management (historical, current, and planned applications), development and management of business requirements and documentation; and project management.
- Applications Team: This team is responsible for applications development, maintenance, and production support.

3.1.7.2 Key IS&T Initiatives

IS&T has been working on several important initiatives pertaining to the future technology needs and security of the Water Department's systems. The following provides a description of key recent initiatives that are led by IS&T.

- Security Upgrades – This consists of security upgrades in conjunction with OIT's cybersecurity initiative. Changes will include a network design upgrade and a new security program. The security upgrades will have some requirements that are specific to the Water Department, however, the goal is to identify gaps and ensure policies are in place to handle security issues appropriately.
- OIT Cybersecurity Initiative – OIT completed an assessment of its systems with respect to security from external parties for its network, firewall, and active directory. A second phase has been completed which looked at the Water Department's networks to assess their security. IS&T is now

performing network design and planning for program development, including the operational technology systems of the Water Department, i.e., SCADA. IS&T will provide more oversight to enhance the security of the SCADA system.

- Disaster Recovery Initiative – The goal of this initiative is to replicate the Water Department's virtual environment in the cloud to allow for operation from remote locations. The cloud based virtual environment will provide the tools to enable recovery of technology infrastructure following a disaster that has been historically held on more local servers. Currently, IS&T is performing a proof of concept for this initiative. The data is now in the cloud environment, and the next portion will be to determine how to transfer workloads to this environment.
- Virtual Workforce Initiative – This initiative is complete. Workers that are not required to be onsite, and that are authorized to work at home are able to do so.

There are also several other initiatives such as the upgrading of older operating systems and wireless networks. The above initiatives will be key to positioning the Water Department to operate effectively and more securely in the coming years.

3.1.8 Water Revenue Bureau

The Water Revenue Bureau (WRB) provides all billing and collection functions for the Water Department. The WRB team reports to the Revenue Commissioner and is ultimately the responsibility of the City's Director of Finance; however, its annual budget is primarily funded from the Water Fund. The key functions of the WRB include:

- Billing – WRB manages the billing system and generates monthly water, sewer, and stormwater bills.
- Collection – WRB collects payment from customers and manages and tracks delinquent accounts. This includes determining interest and penalty assessments, as well as shut off for non-payment if necessary.
- Assistance Programs – WRB manages certain assistance programs for eligible customers and includes Senior Citizen Discount, Tiered Assistance Program (TAP), Water Revenue Assistance Program and payment agreements.

The WRB and Water Department work closely together to ensure the accurate billing and collection of revenue. Both the WRB and Water Department monitor billings and collections and coordinate to address any specific issues. The Water Department is responsible for installing and testing meters. The Water Department is currently implementing a new Advanced Metering Infrastructure (AMI) program which will allow for access to real time meter data from customers. WRB and the Water Department must work together on this project to ensure a successful implementation, including coordination with customers on modifications to metering equipment and how AMI can be utilized by the customer.

3.2 Key Management Initiatives

During our discussions with Water Department staff and management, Arcadis learned about the variety of ongoing initiatives that will continue to be focused on in the coming years. Several of these ongoing initiatives include:

Consent Order & Agreement – The Water Department will continue to work toward meeting the requirements outlined in the COA. This includes a variety of projects in the CIP such as Green Stormwater Infrastructure and other capacity expansion projects to reduce the instances of combined sewer overflows or excessive runoff that reduces regional water quality. The City anticipated meeting all required compliance targets for the Ten-Year Performance Standard prior to outbreak of COVID-19. Restrictions related to the COVID-19 pandemic disrupted, and continue to disrupt, both ongoing and planned construction projects. Thus, the City expects delays meeting the requirements of the Ten-Year Performance Standard. Citing force majeure, the City requested and on April 6, 2021, the PADEP formally granted, an extension for the City to complete the Ten-Year Performance Standard requirements and other deliverables. The PADEP granted the City an extension until December 31, 2021 to achieve the Ten-Year water quality based effluent limit performance standards, and until May 30, 2022 to deliver the Year 10 EAP.

Security – Security continues to be a key initiative for the Water Department. As noted above, the IS&T has been assisting with the City's cybersecurity initiative, which includes enhancing the City's overall protection from cybersecurity threats. This includes assessing the Water Department's operational technology systems and upgrading the security environment around SCADA. As noted elsewhere in this Report, there are several projects recently completed or underway to enhance the physical security at key treatment plant facilities. Additionally, the Water Department completed the Risk and Resilience Assessment (RRA) as required under America's Water Infrastructure Act (AWIA). The RRA certification was submitted to USEPA on March 26, 2020. The Water Department certified that it completed updates to its Emergency Response Plan (ERP) on September 28, 2020.

Water and Wastewater Master Planning – The Water Department prepares master plans for its water and wastewater systems. Key aspects of the Drinking Water Master Plan include projects such as the rehabilitation of the Torresdale and Lardner's Point pump stations, as well as upgrades and improvements at its water treatment plants. The implementation of these projects will result in increased capital spending compared to historical levels. The current Wastewater Master Plan was prepared in 2016 and the Water Department has issued a contract for an update to the Wastewater Master Plan.

The master plans provide the Water Department with a basis for evaluating future CIP needs and position the Water Department to make sound decisions about future capital investments. As part of a regular planning process, the Water Department plans to revisit these master plans every five years.

As part of the Master Plan and other planning and design efforts, the Water Department is involved in planning and analysis of various potential impacts from climate change or regulatory impacts.

Other Pending Regulatory Obligations - Table 3-3 below lists priorities for the Water Department along with the outside agency involved, the significance of the plan/analysis and proposed Water Department actions.

Table 3-3. Water Department Planning Priorities

PWD Priority	Agency	Significance	PWD Actions
Flexible Flow Management Plan (FFMP)	Decree Parties (PA, NJ, DE, NY, NYC)	• The FFMP is critical to preventing salinity intrusion at the Baxter intake. • Current FFMP weakens protection of PWD.	• Investing significant resources to study salinity intrusion and the effects of sea level rise on drinking water supply quality and long-term infrastructure viability.
Aquatic Life Use Attainability Analysis	DRBC	• Use upgrade from fish maintenance to fish propagation would increase the Dissolved Oxygen (DO) standard in the tidal Delaware. • A potential increase in the DO standard could influence Water Pollution Control Plant (WPCP) effluent limits for ammonia and potential other nutrients requiring major capital improvements.	• In advance of regulations, the Water Department is investing significant resources to reduce effluent ammonia at its three WPCPs. • The Water Department also initiated the development of the DO Partnership with other large regional municipal utilities to share strategic utility planning and technology evaluations.
Wissahickon Creek Clean Water Partnership	EPA & PADEP	• PADEP, in cooperation with EPA Region 3, is working with watershed stakeholders interested in developing a Total Maximum Daily Load (TMDL) alternative for nutrients.	• The Water Department is a member of the alternative TMDL development team.
PFAS	PADEP	• PADEP is developing state-specific PFAS drinking water regulations. • Pennsylvania legislators have also introduced bills to address development of MCLs for drinking water.	• The Water Department is investing significant resources to monitor PFAS in the source water and develop analytical techniques for use in the laboratory.
Lead and Copper Rule Revisions	EPA & PADEP	• Additional public education and notification, • Education, sampling, and testing for all schools and childcare facilities every 5 years, • Provision of pitcher filters and follow-up sampling after the replacement of any lead service line, • Additional sampling for determining corrosion control and for follow-up on elevated lead samples, and • Development and maintenance of an inventory of service line materials along with annual communication to those customers who have lead service lines.	• The Water Department will continue evaluating the potential impacts of the LCRR on its operations, staffing needs, outreach efforts, regulatory compliance, and costs for contracting support. The rule revisions do not currently stipulate a timeline for implementation of the requirements.

Climate Change Adaptation - The Climate Change Adaptation Program (CCAP) is addressing climate-related vulnerabilities and risks to the Water Department's drinking water, wastewater and stormwater systems by carrying out in-depth assessments using the best available climate science and supporting the development of cost-effective adaptation strategies that leverage existing programs and processes. A

critical component of this work is ensuring that climate change information is embedded within all levels of infrastructure planning, design, and operations. This has led the CCAP to develop Climate-Resilient Planning and Design Guidance to inform individual projects and long-term planning initiatives. The Water Department is also committed to working with other City agencies, local and regional partners, stakeholders, scientists, industry experts and officials from all levels of government to address climate change.

Energy Management - Energy management is essential to the Water Department's commitment to sustainable utility operations. Recognizing the interdependency of water and energy infrastructure, the Water Department manages the large-scale energy requirements for its operations by monitoring and evaluating energy usage and pursuing resource recovery projects to increase energy independence. The Utility Wide Strategic Energy Plan (2017) responds to the urgency of climate change proactively, by mitigating the Water Department's contribution to climate change, in tandem with their climate change adaptation efforts. The Water Department's Utility Wide Strategic Energy Plan (UWSEP) is supported by four core goals:

I. Strive to maintain a stable energy footprint by increasing energy efficiency.
II. Reduce greenhouse gas emissions 50% by 2030.
III. Continue to pursue renewable energy generation and resource recovery.
IV. Maintain or reduce energy costs and provide budget certainty to the ratepayer.

The Water Department has already taken many steps to decrease greenhouse gas emissions, including the installation of energy efficient equipment, and the use of renewable fuels and onsite electricity generation at its wastewater treatment plants.

Advanced Metering Infrastructure - The Water Department is in the midst of implementing AMI for its system and customers. The AMI program will provide the Water Department and customers with the ability to view customer meter information in real time. Over the next several years, contractors and staff will be installing the necessary equipment on customer meters, as well as establishing the Meter Data Management System. The AMI system should provide for enhanced meter read capability for billing operations, as well as useful data (e.g., customer use patterns and system conditions) for Water Department operators and engineers to better plan for the future.

Rate Proceedings - The Water Department completed its most recent rate proceeding during the summer of 2021 which approved water, sewer, and stormwater revenue increases of 1.85 percent and 5.89 percent for FY 2022 and FY 2023, respectively. The FY 2023 incremental increase is subject to adjustment via a Special Rate Reconciliation Proceeding which the Water Department needs to initiate by March 1, 2022. This Special Rate Reconciliation Proceeding is discussed further in Section 2 of this Report. Additionally, it is anticipated that the Water Department will need regular rate proceedings to adjust rates and charges beyond FY 2023 as it continues to invest in the System. This will require consistent attention to ensure rates are adjusted sufficiently and in a timely manner.

Affordability Assistance Programs – The Water Department maintains several customer assistance programs which includes (i) Senior Citizen Discount Program (ii) Tiered Assistance Program (TAP) (iii) Long Re-Payment Agreement Program with extended repayment plans and (iv) Water Revenue Assistance Program (WRAP). The Senior Citizen Discount Program provides for a 25% discount off the

customer's water and sewer bill for eligible customers at least 65 years of age with a combined household income of $32,300 or less.

The Tiered Assistance Program has been in place for approximately four years and provides an expanded approach by the Water Department to provide bill payment assistance to low-income customers. In lieu of paying for water, sewer, and stormwater service based on their meter size, usage, and parcel information, which are typical billing units, the customer pays for service based on a percentage of their annual income. Customers do not have to be delinquent on a bill payment to be eligible; however, they must qualify by providing evidence of their annual income. If the annual income is less than 150 percent of the federal poverty level, the customer can be eligible to pay 2 percent to 3 percent of their annual income. Certain customers with special hardships can pay 4 percent of their annual income. As of December 30, 2020 there were 26,097 customers enrolled in the Senior Citizen Discount Program and 12,000 TAP participants.

The Water Department has been working to educate the public about the program and enroll qualifying customers. By enrolling certain customers in TAP, the Water Department hopes to achieve more stable and predictable payments from low-income customers and avoid instances where customers fall behind on their payments and eventually become delinquent. The settlement terms of the Water Department's 2021 rate proceeding include a commitment to evaluate new approaches to increase outreach to customers with respect to TAP. The Water Department also agreed to report monthly on the amount and type of arrearage forgiveness provided to TAP customers and reports are posted to the Board's webpage. In the October 15, 2021 report, the Department detailed there are no legal barriers to implement ratable forgiveness for each month the TAP participant pays the TAP bill and is currently working on regulations which govern such matters. Further, the Water Department is reviewing how to reduce TAP denials and recertification delays.

Since TAP provides a discount to customer bills, there is a revenue impact that is discussed in Section 2 of this Report. The Water Department estimates that the FY 2022 revenue offset will be approximately $9.3 million related to TAP customers, which is recovered via a surcharge that was approved by the Rate Board during the recent rate proceedings.

3.3 Conclusions

It is our opinion that:

- The Water Department has an organizational structure that facilitates accomplishing its mission of reliably delivering high quality water; treating wastewater to high standards; and effectively managing stormwater for its customers. Water Department divisions are appropriately focused on the operational, planning, engineering, and administrative functions that are common to effective water and wastewater utilities.
- Divisions are led by experienced managers capable of leading staff to provide effective system operations, maintenance, and administrative management to maintain adequate and reliable service levels.
- The Water Department, similar to other employers, and specifically water and sewer utilities, is having an increasingly difficult time in hiring qualified people for skilled and semi-skilled positions, resulting in

a relatively higher vacancy rate compared to previous years. With many skilled positions being comprised of an aging workforce, regular retirements, an increasing number of paid days lost, and the inability to fully staff certain areas, the Water Department has recently been unable to consistently achieve its targeted level of proactive maintenance in several areas, while focusing more on reactive maintenance. If staffing shortages are prolonged, this could eventually lead to decreased service life of equipment and additional capital or maintenance costs. Another challenge is that the overall hiring process appears slow to react, taking several months or longer to fill an open position when vacancies become available, or when vacancies are known to be pending due to retirement or leave situations. The shortage of qualified staff may potentially be exacerbated as vaccine mandates by the City may result in termination of certain Water Department staff that do not comply with the City's mandate. Arcadis recommends that the Water Department pay particular attention to staffing issues to ensure that critical management and maintenance activities continue into the future.

- The Pandemic created additional administrative challenges to the Water Department, including transition to work from home, modifications to office and workspaces, enhanced safety precautions, modified work shifts, and temporary administrative hurdles on hiring new staff. These issues have required additional effort and time from management and staff compared to the normal course of business. The Water Department adapted to effectively perform its mission. It will now be critical for the Water Department to navigate additional challenges while transitioning back to a pre-Pandemic posture that effectively implements the key initiatives above.

4 WATER SYSTEM

4.1 Introduction

The major elements of the water system include three supply intakes located on the Schuylkill and Delaware Rivers, three treatment plants, storage facilities, and a conveyance and distribution system. Figure 4-1 shows the major water system facilities and general service area. As is shown, the Belmont and Queen Lane water treatment plants rely on the Schuylkill River for supply, while the Baxter Water Treatment Plant's source of supply is the Delaware River. The water system has been providing service to customers since the year 1801. Currently, the general service area consists of City limits. The Water Department also has one wholesale water agreement with Aqua Pennsylvania. As of April 1, 2020, the U.S. Census Bureau estimates that approximately 1.6 million persons live in Philadelphia County. The following sections provide an overview of the major water system assets, as well as current Water Department initiatives and key operating units.

4.2 Water Supply

The Water Department relies on the Delaware River and Schuylkill River for its water supply via permits from PADEP and the Delaware River Basin Commission (DRBC). Per the average day treatment plant production rates noted in this Report, the Water Department obtains approximately 56.8 percent of its supply from the Delaware River, with the remaining 43.2 percent from the Schuylkill River supply. Water supply permit capacities are reflected in Table 4-1.

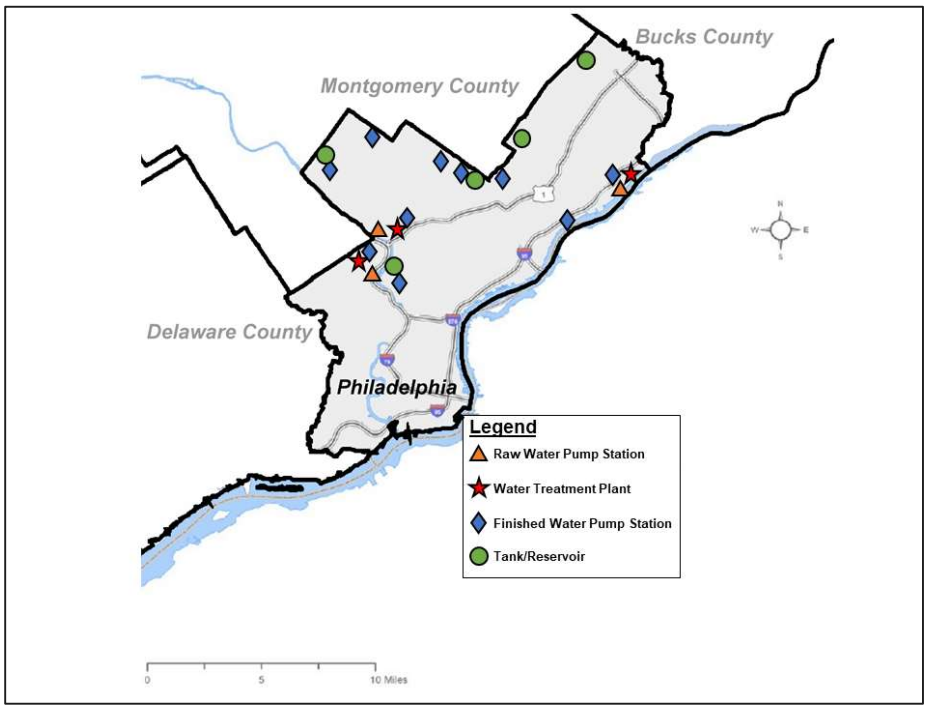

Figure 4-1. Overview Map of Major Water System Facilities

4.2.1 System Capacity

The water system must be sized to meet the average day and peak demands of the system. Over the years the Water Department has designed and built the water system to provide a reliable, redundant supply of water to customers during peak demands. Table 4-1 presents the Water Department's water system capacities for raw water withdrawal, treatment, and storage facilities. The Water Department operates these assets to provide water service during average and peak demand periods. The total rated capacity of the three water treatment plants is 546 mgd. The capacities of other elements within the water supply system appear in Table 4-1.

As noted in Section 2 of this Report, in recent years the Water Department has been experiencing declining billed usage from its customers, as well as stable growth in its customer base. As noted on the annual water audit shown in this Report, the total water supplied for FY 2020 was approximately 220.6 mgd, which includes 219.2 mgd supplied to the City of Philadelphia and approximately 1.4 mgd of wholesale water to serve Aqua Pennsylvania. This volume is well within the capacities listed in Table 4-1. The combined peak production rates for the three treatment plants are reflected in subsequent sections and are also well within the Table 4-1 capacities. In Arcadis' opinion, the water treatment, storage, and distribution facilities are of adequate capacity to provide for the present and foreseeable future customer demand requirements. The additional capacity also helps to provide redundant service during emergency periods. Recently, and as described further in Section 4.4.3 of this Report, the Belmont Water Treatment Plant's raw water pump station was flooded as storm remnants from Hurricane Ida moved over Philadelphia. The Water Department had to temporarily shut down the Belmont Water Treatment Plant but was able to provide service to its entire service area using production from the Baxter and Queen Lane Water Treatment Plants.

Table 4-1. Water System Capacities

Facility	Raw Water Pumping Capacity (mgd)	Maximum Daily Withdrawal (mgd)	Hydraulic Treatment Capacity (mgd)	Treatment Capacity, Partnership for Safe Water (mgd)	Total Raw Water Storage (mg)	Total Finished Water Storage (mg)
Queen Lane Plant	200		150	140	207	85
Belmont Plant	170		110	86	83	42
Schuylkill Supply		258				
Baxter Plant	480		420	320	170	207**
Delaware Supply		423***				
Distribution System*						214**
System Totals	**850**	**681*** **	**680**	**546**	**460**	**548**

mg – million gallons
mgd – million gallons per day

* Includes treated water stored at the East Park, Roxborough, Somerton, Fox Chase, and Oak Lane storage facilities.

** Reflects current treated water capacity. See Sections 4.4 and 4.5 for explanation of projects that will increase storage capacity.
*** Per PADEP

4.3 Water Quality Compliance

Arcadis reviewed information related to the Water Department's drinking water compliance and associated initiatives. The following sections provide an overview of compliance with current regulations, as well as ongoing initiatives and actions to meet anticipated future regulations and water quality goals.

4.3.1 Partnership for Safe Water

The Water Department participates in the Partnership for Safe Water Program (Partnership), through a voluntary agreement with USEPA initially signed in January 1996. The treatment plant segment of the Partnership includes a commitment by utilities that treat surface water to use practices and procedures that significantly reduce the turbidity of treated water. The Water Department's participation in the Partnership has resulted in substantially better water quality. Data provided by the Water Department shows finished water turbidity levels that are approximately 0.05 NTU compared to the regulatory limit of 0.30 NTU. The Partnership treatment practices limit the total maximum treatment capacities for the three treatment plants to 546 mgd. This is still well over recent average day and maximum day system demands. There are four phases to the treatment segment of the Partnership program including:

1. Commitment – The utility commits itself to the Partnership program.
2. Baseline and Annual Data Collection
3. Self-Assessment
4. Fully Optimized System

In 2019, the Water Department received the 20-year Director's Award marking twenty consecutive years achieving Partnership Phase III goals. This includes completing a treatment plant self-assessment and submitting turbidity data that reflects consistent production of high-quality water. The self-assessment and turbidity data are peer reviewed by treatment plant experts to ensure it meets or exceeds all Phase III requirements. The Water Department continues to consistently demonstrate lower turbidity levels, and this performance has helped it comply with other regulatory requirements such as the Interim Enhanced Surface Water Treatment Rule and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR).

The Water Department had been a charter member of the Partnership distribution system optimization program; however, they are not currently participating due to a need to review and finalize the Phase III Self-Assessment report. This Partnership program is for utilities that add a disinfectant to finished water and seek to optimize the management of distribution systems to realize benefits including:

- Improved water quality
- Recognition within the water industry
- Regulator confidence
- Consumer confidence and community support
- Employee support

Similar to the Partnership treatment program, the Partnership distribution system program consists of four phases that begin with Commitment and drive toward the goal of achieving a fully optimized system. By striving towards a fully optimized system, utilities can achieve consistently better overall water quality within their distribution systems. The Water Department indicated that it had previously completed and submitted Phase II: Baseline and Annual Data Collection. The Phase III: Self-Assessment report was drafted internally at the Water Department but was not finalized, nor submitted. Additionally, the annual data necessary to remain in the Partnership distribution program has not been updated.

The self-assessment (Phase III) includes a performance assessment that focuses on water quality, pressure levels, and the number of main breaks. It also includes the use of an optimization assessment tool that helps utilities identify Performance Limiting Factors (PLFs) and where opportunities for improvement exist. The Water Department reports that these efforts and tracking of data necessary to participate in the program are intended to start again in the near future.

4.3.2 Water Quality Compliance

Arcadis reviewed the Water Department's annual Drinking Water Quality Report for the calendar year 2020. The following Table 4-2 presents the results of our review of the data provided. The Table reflects the key drinking water requirements, a brief description of the Water Department's practices for achieving compliance, and our assessment of their current compliance with the applicable requirement. The Water Department did receive a Field Order in July 2021 noting a violation due to openings in the top of the existing Baxter Plant Clearwell Basin. These were initially identified in 2019 and the violation stemmed from the failure to promptly notify PADEP of such condition (within one hour). The Field Order required covering all openings and performance of additional monitoring of the existing clearwell basin and water quality. The Water Department covered the openings within a few weeks of receiving the field order and is continuing to perform additional water quality monitoring. The new clearwell basins (Clear Well Basins 1&2) are under construction to replace the existing clearwell basin.

4.3.3 Surveillance and Response System

The Bureau of Laboratory Services is primarily responsible for monitoring the Water Department's Surveillance and Response System (SRS). This system includes sensors placed in the distribution system that allow the Water Department to conduct online monitoring of certain water quality parameters. This system provides the ability to detect, confirm, respond to, and remediate contamination of the distribution system. The Surveillance and Response System (SRS) has five core components, including:

- On-line water quality monitoring
- Enhanced response sampling and analysis procedures
- Customer complaint surveillance
- Enhanced security monitoring
- Public health surveillance

BLS monitors the SRS and has developed associated plans and training to be ready in the event that an incident is detected and requires response. The SRS is continuously being updated and replaced with the latest available technology.

Table 4-2. Summary of Drinking Water Quality Regulations and Compliance

Rule	Key Requirements	Water Department Activities	Compliance
Lead and Copper Rule (LCR)	90% of samples collected in a monitoring round must be below the action levels of 0.015 mg/L for lead and 1.3 mg/L for copper. Systems serving more than 50,000 people were required to install corrosion control treatment (CCT) and must perform routine monitoring for a defined list of water quality parameters (WQPs)	The Water Department practices optimal CCT at all three plants by adding zinc orthophosphate at a dose of 1.5 mg/L as phosphate and maintaining finished water pH in the range of 6.8 and 7.8, and performs the required WQP monitoring at each point of entry and in the distribution system. Most recent tests for LCR compliance sampling took place in 2019.	The Water Department is in compliance with the LCR.
Revised Total Coliform Rule (RTCR)	Requires routine sampling for total coliform from representative sites throughout the distribution system	The Water Department collects and analyzes samples for total coliforms and *E. coli* from over 80 representative locations throughout the distributions systems.	The Water Department is in compliance with the RTCR.
Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rule (DBPRs)	Established maximum contaminant levels (MCLs) and operational evaluation levels (OELs) for total trihalomethanes (TTHMs) and the sum of five haloacetic acids (HAA5) and maximum residual disinfectant levels (MRDLs) for chlorine, chloramines, chlorine dioxide, chlorite, and bromate.	The Water Department collects and analyzes samples at 16 locations throughout the City of Philadelphia and in accordance with the Stage 1 and Stage 2 DBPR monitoring requirements.	The Water Department is in compliance with the Stage 1 and Stage 2 DBPRs.
PADEP Disinfectant Requirements Rule (DRR)	Requires reporting of individual disinfectant residuals from RTCR monitoring locations and establishes a minimum disinfectant residual of 0.2 mg/L in 95% of water distribution samples collected each month.	This rule is now in effect and the Water Department is meeting the rule without major capital investments.	The Water Department monitors and reports chlorine residual data in accordance with a Sample Siting Plan prepared by the Water Department and on file with PADEP.

Rule	Key Requirements	Water Department Activities	Compliance
Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)	Requires additional treatment based on the concentration of Cryptosporidium or *E. coli* in source water.	Queen Lane and Baxter Plants are designated as Bin 2 under the rule, requiring an additional 1.0-log removal/inactivation of *Cryptosporidium*. The Water Department meets this requirement through very low turbidity levels in the combined filter effluent (CFE) and individual filter effluent (IFE) at both plants. The Queen Lane Plant also achieved a back-up 0.5-log treatment credit by implementing a Watershed Control Program Plan. In October 2018, a letter was submitted to PADEP indicating the Water Department's intent to expand the Watershed Control Program Plan into the Delaware River Watershed to achieve a 0.5 log back-up credit to Baxter's IFE and CFE requirements. The updated Watershed Control Program Plan was submitted to PADEP in October 2020 and was approved in June 2021.	The Water Department is in compliance with the LT2ESWTR.
Consumer Confidence Report (CCR) Rule	Requires a CCR to be provided to Water Department consumers annually	The annual report meets and exceeds the USEPA requirements and includes educational information regarding source water protection, water treatment processes, research, and outreach initiatives.	The Water Department is in compliance with the CCR rule.
Unregulated Contaminant Monitoring Rule (UCMR)	Requires sample analysis for a specified list of unregulated compounds.	The Water Department completed monitoring for the required contaminants as part of the Fourth UCMR, the last stage was completed in calendar year 2020.	The Water Department is in compliance with the UCMR.

4.3.4 Annual Water Audit

The Water Department was a leading contributor to the water industry's current standard for performing water audits. The water audit provides utilities with an assessment of the utilization of water delivered to the distribution system. It accounts for water that is metered and billed to customers, as well as water that is not accounted for due to real and apparent system losses. Real losses consist of unmetered water due to main breaks, leaks, or other physical losses. Apparent losses consist of unmetered water due to inaccurate metering or billing, or unauthorized usage.

The Infrastructure Leakage Index (ILI) provides a performance indicator for utilities to assess their management of real losses compared to unavoidable real losses. Generally, an ILI greater than 8.0 reflects that more efficient utilization of water can be achieved. The Water Department's annual water audit for FY 2016 through FY 2020 is presented below in Table 4-3. As noted in this Report, the Water Department is working to improve the instances of non-revenue water through main replacement, leakage reduction, and pursuit of unauthorized usage among other measures. As these initiatives move forward, the annual water audit results should help to assess the effectiveness of these initiatives over time. Additionally, the implementation of AMI should provide better data to further refine Real Loss and Apparent Loss.

Table 4-3. Water Audit Results

Component	FY 2016	FY 2017	FY 2018	FY2019	FY2020
Water Supplied, mgd	223.2	223.1	223.2	221.7	220.6
Billed Consumption, mgd (may include some unmetered consumption)	133.0	131.4	128.8	129.4	126.0
Non-Revenue Water, mgd	90.2	91.7	94.3	92.4	94.7
Percent Non-Revenue Water by volume	40.4	41.1	42.3	41.7	42.9
Percent Non-Revenue Water by cost	20.2	16.9	16.2	16.0	16.9
Unbilled Authorized Consumption, mgd	3.7	4.0	4.2	5.9	5.8
Unbilled Authorized Consumption Costs million	$1.32	$1.32	$1.34	$1.64	$1.65
Apparent Losses, mgd	15.7	17.3	15.4	16.5	12.7
Apparent Losses costs, million	$39.1	$45.0	$42.3	$47.1	$38.5
Real Losses, mgd	70.8	70.4	74.7	69.9	76.2
Real Losses costs, million	$9.9	$7.5	$8.0	$8.2	$9.1
Infrastructure Leakage Index, dimensionless	9.9	9.9	10.4	9.7	10.8

Source: Philadelphia Water Department Annual Water Audit Summary

4.3.4.1 Leakage Management

The Leak Detection Survey program has been managed successfully within the Water Conveyance Section for many years using a combination of approaches and applications including:

- Traditional leak detection and repair activities (find and fix approach)
- Advanced technologies such as pressure management (predict and prevent approach)
- Highly sensitive leak detection applications for large water mains.

Leak detection crews use leak detection technology (leak correlators and correlating leak loggers) to proactively survey the water distribution system for hidden leaks. In FY 2020, the Water Department surveyed 904 miles of small diameter mains and abated approximately 34.9 mgd of leakage. Summary results of this program are presented in Table 4-4.

Table 4-4. Leak Survey

Service Parameter	FY 2016	FY 2017	FY 2018[1]	FY 2019	FY 2020	FY 2021
Leak Survey (miles of pipeline)	799	1,052	742	746	904	803
Leakage Abated (mgd)	14.1	14.0	46.6	41.7	34.9	Not Available [2]

(1) In FY 2018 corrections to reporting methodologies were developed and implemented by Leakage Management staff. Per discussion with staff, it will take several fiscal years to establish trending with this improved reporting.
(2) Not available until FY 2021 water audit is complete.

The Water Department has recently revised its reporting methodologies related to tracking and measuring the amount of leakage abated. The revised methodology incorporates the full monthly reporting period whereas previously portions of the monthly reporting period were truncated and not included in report totals for leakage abated.

The Water Department continues efforts to optimize operations of the distribution system for leakage control. This includes using and integrating programs such as acoustic leak detection and water main replacement. Flow modulated pressure control is also used to reduce the potential for leakage. This includes using pressure reducing valves to maintain more optimal system pressures as a means for reducing small leaks or seepage, as well as monitoring the system for change in flows to identify new instances of leaks.

4.3.5 Water System Planning

The following sections provide an overview of the recent Drinking Water Master Plan and associated planning related to linear assets.

4.3.5.1 Drinking Water Master Planning

The Water Department has been providing water service to City residents since the 1800s. The City experienced significant growth in the 1900s and much of the facilities in service were placed into service during this period, making them almost 100 years old in many instances.

The Water Department's Drinking Water Master Plan charts the course for a comprehensive 25-year program to upgrade these critical water facilities. The plan evaluated system needs over the long term and proactively plans for major upgrades, and in some cases complete reconstruction to upgrade the City's drinking water treatment, pumping and storage facilities.

The three water treatment plants are aging and will require significant repairs to prepare them for long term service. The Drinking Water Master Plan anticipates upgrades to the Baxter Water Treatment Plant, an expansion and upgrade to the Belmont Water Treatment Plant, and reconstruction of the Queen Lane Water Treatment Plant. These improvements are planned over the next 25 years and are deemed necessary by the Water Department to maintain a sufficient, safe, and reliable supply of water for the citizens of the City.

The Drinking Water Master Plan identified approximately 400 projects focused on the rehabilitation of existing facilities, complete reconstruction of several existing facilities, and construction of several new facilities. The combined estimate of these projects over the next 25 years is $2.5 billion.

The following is a high-level list of the major facility project focus areas listed in the master plan:

- Lardner's Point Pump Station
- Baxter Water Treatment Plant Upgrades
- Belmont Water Treatment Plant Expansion and Upgrade
- Queen Lane Water Treatment Plant Reconstruction
- East Oak Lane Reservoir and Pump Station Reconstruction
- Fox Chase Pump Station
- Torresdale Pump Station Rehabilitation
- Georges Hill Pump Station
- Various Transmission Main Improvements, including water system interconnectivity and redundancy projects

Several of key projects are in the planning or design stages and are included in the six-year CIP, including the Lardner's Point Pump Station, East Oak Lane Reservoir replacement, and Georges Hill Pump Station projects. However, due to the Pandemic, several capital projects have been delayed so the overall time period for implementation of the master plan projects may be extended.

4.3.5.2 Linear Asset Planning

As shown in Figure 4-2, over the past 20 years the Water Department has seen a slight increasing trend in water main breaks. To maximize the benefit of its investment in water main replacement, the Water

Department uses Innovyze's® CapPlan Water to prioritize main replacements using a risk-based approach that considers both likelihood and consequence of failure. Based on the 58 Fiscal Year Main Break Repair History report there were 772 breaks in FY 2021. The 58-year annual average is 824 breaks. For comparison the Water Department experienced 612 breaks in FY 2020 and 778 breaks in FY 2019.

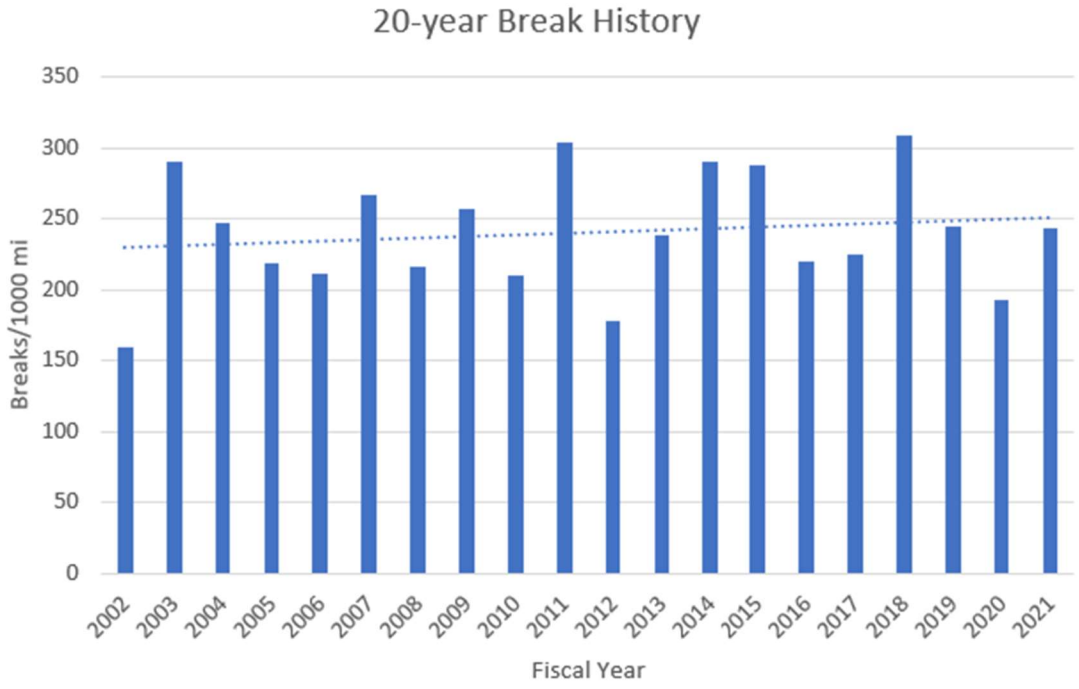

Figure 4-2. 20-year Break History

The Water Department conducts a risk analysis to determine which water mains should be replaced each fiscal year. This analysis considers both likelihood of failure and consequence of failure. Factors included in the analysis are pipe age, material, diameter, installing contractor and impacted customers.

The Water Department is increasing its planned water main replacements to levels significantly above recent rates of replacement, which were limited by available funding and other system priorities. Table 4-5 shows the actual recent and target future quantity of water mains to be replaced as provided by the Water Department. The reported values represent the miles of water main projects encumbered in the fiscal year. Actual construction typically begins shortly after the projects are encumbered with the majority of the project work typically completed within one year. The actual water main replacement mileage encumbered in FY 2021 was 11.28 miles due to delays related to the Pandemic. the Water Department anticipates that it will be three years before it reaches the longer term goal of replacing 42 miles of water main on an annual basis. Over 200 miles of water main replacements are either in design or have completed designs and awaiting bidding. The target increased rate of replacement was established with the goal of reducing the frequency of water main breaks. At the 42 miles per year target rate of replacement in FY 2024, the entire system would be replaced in approximately 75 years. This

target increase in main replacements would be an improvement over recent replacement rates if it can be achieved. The effectiveness of the program (e.g., impact on main break rates) should be monitored over time to determine if future adjustments to the replacement rate are warranted. The additional cost related to the higher target replacement rate is included in the CIP and in the financial projections in Section 2 of this Report.

Table 4-5. Water Main Rate of Replacements

Fiscal Year	Water Mains Replacements Encumbered (mi)	Notes
2017	19.27	Actual
2018	19.01	Actual
2019	18.83	Actual
2020	10.68	Actual
2021	11.28	Actual
2022	38	Target
2023	40	Target
2024 & Beyond	42	Target

Actual and target amounts provided by the Water Department

4.4 Water Treatment Plants

In October 2021 Arcadis staff visited the three water treatment facilities. Interviews with key staff were held and a walkthrough of the facilities was conducted to develop a general understanding of the facilities' condition.

The facilities are located, and were designed, to provide system flexibility and redundancy. Two of the plants, Queen Lane and Belmont draw water from the Schuylkill River. The Baxter Plant uses the Delaware River for water supply. Having these multiple, separate sources creates redundancy in supply and operational flexibility as recently demonstrated during the early September 2021 floods from the storm remnants from Hurricane Ida. Each of the plants has redundant equipment for treatment and pumping. The treatment at each facility is similar and consists of sedimentation, coagulation, flocculation, clarification, anthracite and sand media filtration, disinfection, fluoridation and corrosion control.

The Water Department has an active capital improvement replacement program. This was evident when Arcadis toured the facilities, viewing multiple projects that were either in on-going construction phases or were recently completed. The capital improvement plan was reviewed and projects in the planning, design, and contracting phases were discussed. A partial list of the major projects and their status in the project pipeline is included later in the Report.

The Water Department evaluates upcoming facility needs and develops the CIP for funding the design and construction of improvements. The drinking water master plan sets forth the long-term road map for

major rehabilitation or replacement of the water treatment facilities. The plans are flexible, realizing that priorities change, and the Water Department reprioritizes to meet the needs of the facilities and maintain compliance. In addition to the capital replacement projects, regular preventative maintenance is scheduled using a centralized program to prioritize preventative and corrective actions. The facilities visited appeared to be adequately maintained and the projects in the pipeline for planning, design, and construction provide additional evidence that the Water Department plans projects as necessary to continue to maintain their facilities in good working order.

In order to develop long range plans for continued compliance and improved operations, the Water Department has performed pilot studies, bench scale testing, and full-scale tests to evaluate various potential changes to the treatment processes. These studies are then incorporated into the recommendations for upgrades, repairs or reconstruction of facilities included in the Drinking Water Master Plan. As the Pandemic caused a delay in the Water Department's rate case and has impacted the overall timing of capital funding, the timeframe for implementing Drinking Water Master Plan projects may need to be extended.

4.4.1 Baxter Water Treatment Plant

The Delaware River serves as the source of supply for the Baxter Plant, which has a design capacity of 320 mgd and a peak hydraulic rate of 420 mgd. By comparison, the total system usage was 220.6 mgd and 225.3 mgd for FY 2020 and FY 2021, respectively. Table 4-6 shows daily output from the plant for the past four fiscal years.

Table 4-6. Baxter Treatment Plant Production

Fiscal Year	Average Daily Output (mgd)	Max Daily Output (mgd)
2018	132	169
2019	133	170
2020	129	164
2021	131	157

Residual solids are discharged to the sewer and conveyed to the Northeast WPCP. The filter backwash rule applies to the Baxter Water Treatment Plant since the flow returns to the influent side of the raw water backwash basin. This is the only facility that the Water Department operates to which the backwash rule applies.

The major capital improvement project underway at the Baxter Plant is the replacement of the 100-year-old 40 million gallon (MG) clearwell basin with four 5 MG tanks, interconnecting piping and valves, and associated site work. Construction for the first two 5 MG tanks (Clear Well Basins (CWB) 1&2) is underway. Planning and preliminary design has begun for the installation of CWBs 3&4 under a future contract. Construction of the current CWB 1&2 project is expected to continue through February 2022, while contracts for CWB 3&4 are anticipated to be bid early FY 2023.

As part of the work to construct the new CWBs, excavation near the existing finished water storage basins was required to install a new gate house and series of valves. After the excavation was performed, an inspection revealed some cracking in the walls of the finished water storage basin. These cracks were injected and repaired; however, after the new isolation valves were added, the tanks were re-inspected and cracking was still observed. Submittals for the repairs are nearly finalized. Ground improvement, concrete, and crack injection work is expected to be completed by the end of the calendar year. The steel work is anticipated to be completed in early Spring 2022 due to longer material lead times.

On June 5, 2020, while working on an upgrade to the fluoride system, a temporary tank and feed line connection catastrophically failed at a metallic fitting, resulting in the release of 27,000 gallons of hydrofluosilicic acid. This required a site investigation with soil sampling, which revealed some soil impacts that requires material to be removed and handled as regulated fill. A consultant is preparing a remediation plan, and a contractor is responsible for developing a temporary system to continue operations, which includes a Water Department supplied fluoride tank. The temporary set-up plan has been submitted to PADEP for approval. The temporary tank is still in service while the old storage tanks are being replaced.

Since the vulnerability assessments were conducted in 2002, the Water Department has completed projects identified to enhance security both through physical improvements (e.g., fences, cameras) and cybersecurity enhancements. Other security enhancements are ongoing with anticipated completion in the second quarter of FY 2022. A SCADA system is used to monitor system components and water quality throughout the treatment process. The new clearwell project currently under construction also includes installation of more security cameras, speakers and access control to internal areas.

The following major projects are ongoing at the Baxter Plant (Work No. included in parentheses for contracted projects):

- (60007 & 60008) Drinking Water System Security
- (61097) Baxter HVAC system upgrades.
- (61098) Rehabilitation of Fluoride Storage Tanks
    - Replacement and downsizing of the fluoride storage tanks in keeping with the reduced dosing standard (0.7 ppm as compared to 1.0 ppm). Replacement of the chemical feed system.
- (61106, 61107, 61108) New clearwell basins 1 and 2 (discussed above).
- (61111) Flocculator rehabilitation including bearing and shaft replacements.
- (61131) DCS Backup Filter Control System Addition

Major projects currently in the Projects Control/bidding pipeline include:

- (61118) Filter Replacements (12)
- (61120) Carbon Feed System Betterment
- (61122, 61144, 61145, 61146) Zinc Orthophosphate Storage and Feed System Replacement
- (61124) Filter Post Weir Alternative Chlorine Application Point Addition
- (61128) Sludge Pump Chamber Betterment

- (61129) Backwash Pumps and Motor Replacements
- (61143) Ceiling Trolley Cranes and Garage Floor Articulating Lift Replacements
- (61151) Sludge Pump Chamber Betterment (Electrical)

Major projects currently in Design include:

- (61080) Raw Water Basin Outlet Gates Addition – 90% Design
    - Staff is coordinating construction with an emergency intake upgrade project at Torresdale Raw Water Pump Station, as both will require a temporary plant shutdown for underwater inspection. The project is scheduled to be bid in FY 2023.
- (61092) Air/Water Surface Wash System Betterment – Design Started
    - Upgrade of filter surface wash to air-scour technology.
- (61103) Masonry Repairs and Window/Door Replacement – 30% Design
    - Window and door replacements at the pre-treatment and filter buildings. Exterior inspection of all Baxter buildings and masonry repairs as necessary.
- (61110) New Process Lab Addition – 30% Design
    - Establishment of a new process control laboratory and sample collection lines.
- (61125) Filter Replacement – Design Started
- (61126) Clearwell Basin Replacement-Tanks 3&4 – 60% Design
- (61132) Filter Drains and Influent Valves Replacement – 30% Design
- (61133) Sodium Hypo Tanks Replacement – Design Started
- (61135) Flocculation and Sedimentation Basin Betterment – Design Started
    - Concrete rehabilitation and protective coating of basin walls, floor slabs, columns, and tie beams.
- (61136) Process Lab Water Sampling Lines Replacements/Additions – 60% Design
- (61137) Wash Water Main Isolation Valve Replacement – Design Started
    - Replacement of the eight 54" butterfly valves with manual actuators.
- (61138) Baxter FWS Courts 1, 2, 3 Valve Replacements/Additions – Design Started
- (61139) Pre/Applied Hydrated Lime Dosing Betterment – Transmitted to Design
    - Replacement of hydrated lime dosing lines to prevent clogging.
- (61140) Admin/Filter/Pre/Post/Intake Buildings Roof Replacement – Design Started
- (61141) Intake/Pre-treatment/Filter/Post Buildings Masonry and Paving Betterment – Design Started
- (61147) Ferric Delivery System Betterment – Design Started
- (61149) Motor Control Centers Replacement – Transmitted to Design

- (61153) Baxter North Pre 96" valve replacement – Design Started
- (61154) Carbon Storage Betterment – Design Started
  - Repair and reline four carbon storage tanks.
- (61155) Washwater Towers Industrial Coating/North Control Valve & Supply Piping Replacement – Design Started
- (61156) Replace Media/Underdrain for (22) Filters – Design Started

4.4.2 Queen Lane Treatment Plant

The Schuylkill River serves as the source of supply for the Queen Lane Plant and has a rated capacity of 140 mgd. Table 4-7 shows daily output from the plant for the past four fiscal years.

Table 4-7. Queen Lane Treatment Plant Production

Fiscal Year	Average Daily Output (mgd)	Max Daily Output (mgd)
2018	50	102
2019	50	71
2020	53	68
2021	57	86

Residuals from the flocculation and sedimentation basins along with the filter backwash water are sent to the Southeast WPCP. If necessary, the plant has the capability to send residuals to the Northeast WPCP or Southwest WPCP for disposal as well.

Since the vulnerability assessments were conducted in 2002, the Water Department has implemented most of the recommendations to improve security, and all internal plant measures are complete. Construction of security upgrades which include new fencing and lighting around the clearwell basin, a new driveway, and new maintenance entrance are substantially complete with final punchlist items and staff training to be complete in FY 2022.

The Queen Lane Treatment Plant had three underground ferric storage tanks that were installed on or before October 11, 1997. These tanks were previously exempted from regulation as a matter of policy set forth in the PADEP Technical Guidance Document 263-2320-001, Policy for Existing Field-Constructed Hazardous Substance Underground Storage Tanks at Facilities Regulated Under the Safe Drinking Water Act. On January 19, 2019, PADEP rescinded Technical Guidance Document 263-2320-001, and as a result, the listed ferric chloride Underground Storage Tanks (USTs) became subject to regulation under the Tank Act (Act 32 – Storage Tank and Spill Prevention Act) and 25 Pa. Code Chapter 245. To comply with this change in regulations, the Water Department registered these tanks with PADEP on March 20, 2019.

In addition, a consent order agreement (COA) was signed between PADEP and the Water Department regarding the ferric chloride USTs. As detailed in the COA, PWD was required to either A) permanently close the ferric chloride USTs, B) bring the tanks into operational compliance, or C) perform a change-in-service for the USTs by June 30, 2020. The Water Department has chosen Option C (change-in-service). Due to some delays in the ongoing capital project for the new ferric tanks, the change in service due date for Queen Lane was extended to extended to June 30, 2021. The Water Department met this COA date and the COA is now closed out.

The following major projects have been completed at the Queen Lane Plant (Work No. included in parentheses for contracted projects):

- (63096) Phase I for the renovation of the pretreatment building is complete. Phase I involves the removal of old chemical storage tanks. Phase II which had initially consisted of designing a layout for future use as office space, a conference room, and storage areas has been deleted as a project.
- (63089) Rehabilitation of Filters 23, 25, 7 and 38 was completed in FY2021.
- (63099) Flocculation/Sedimentation Basins Concrete Repairs and the Replacement of Drain Valves – Bids have been received.

Major projects with ongoing construction and anticipated completion dates include the following:

- Distributed Control System (DCS) software upgrade is complete. Hardware upgrades are continuing with two of the four DCS cabinet upgrades complete; the remaining cabinet upgrades are scheduled in FY 2022 and FY 2023.
- (60007/60008) Drinking water system security improvements are 95% complete with punchlist items remaining.
- (63090) Replacement of two fluoride tanks is complete. Installation of the five new ferric tanks at the 95% completion level and expected to be completed during calendar year 2021.
- (63057) Plant roadway betterment is anticipated to complete construction in FY 2022.
- (63082) Replacement of the backwash pumps, valves, actuators and vacuum breakers. Notice to proceed has been issued and pumps have been ordered. There is an anticipated 6-month lead time for the pumps before construction begins on-site. is in Projects Control and anticipated to be bid in FY2021.
- (63083) Repair of cracks in the south clearwell and replacement of the roof bid has been awarded and awaiting a notice to proceed date.

Major projects in Design or Projects Control pipeline include:

- (63061/63062/63063) Butler Building and (63077) Hydrated lime feed storage system upgrade are combined as one project and are in Design. (63072) Dredging of the raw water basins to remove accumulated sediment is currently on hold but is expected to bid in FY 2022 and be funded out of the operating budget.
- (63079) Replacement of butterfly backwash valves and actuators on the north filters is in Projects Control.

- (63087) The rehabilitation of plant sewers is in Design.
- (63088) Sluice gates motorized valves betterment is in Project Controls.
- (63093 & 63094) 24 filter replacement is in Design. Each set of 12 filter replacements occurs by taking one unit out at a time over roughly 8 years.
- (63095) Replacement of Surface Wash system with Air/Water Wash System for 40 filters is in Projects Control.
- (63097) Sodium hypochlorite tank replacement is in Design.
- (63098) Automated filter to waste betterment is at the 30% Design level.
- 63107 Repair of cracks in the north clearwell and replacement of the roof bid is in design

Future Projects that have been sent to Design but are awaiting Master Plan level decisions for timing include:

- (63104) Central Court and Drainage Betterment
- (63105) Replacement of 10 Dual Media Filters
- (63106) Roof and Plumbing System Betterments at the Filter Building and Chemical Maintenance Building
- (63107) North Clearwell Basin Roof Replacement and Structural and Mechanical Betterment
- (63108) Filter Building Structural Betterment and Pumping Station Crane Replacement at Queen Lane
- (63109) Switchgear Replacement at Pretreatment Building and Transformers Betterment

Queen Lane Plant has the responsibility of maintaining the reservoirs at the plant. In prior years they had hired landscape contractors to maintain the vegetation, however this year due to contractor labor shortages, they were unable to procure outside contractors to perform this work. This effort fell to plant staff to maintain the reservoir and the Water Department acquired a remote mower to ease the labor required. There are 8 vacancies that Human Resources is continuing to find personnel to fill, however, shift vacancies are increasingly harder to fill.

4.4.3 Belmont Treatment Plant

The Schuylkill River serves as the source of supply for the Belmont Plant and has a rated capacity of 86 mgd. Table 4-8 shows daily output from the plant for the past four fiscal years.

Table 4-8. Belmont Treatment Plant Production

Fiscal Year	Average Daily Output (mgd)	Max Daily Output (mgd)
2018	45	62
2019	45	55

Fiscal Year	Average Daily Output (mgd)	Max Daily Output (mgd)
2020	44	52
2021	44	55

The residuals from Belmont's flocculation and sedimentation basins, as well as the filter backwash, are sent to the Water Department's Southwest WPCP for processing.

As part of the investigation into various methods to reduce disinfection byproduct production the plant was conducting intermittent trials for switching to post-filtration chlorine contact. Part of the clearwell was converted to a post-filter chlorine contactor in 2008 and full-scale trials of post-filter chlorination were promising. Trials were discontinued in 2013 as the rehabilitation of the raw water basin had limited the plant's operational flexibility. Since completion of this work in 2017, the trials were restarted and continued through July 2019. The Water Department previously anticipated that additional trials would begin again sometime in calendar year 2021. However, the Water Department currently has no desire to restart the permit approval process that would be required for this effort. The plant is in compliance with the requirements for disinfection byproducts.

The Drinking Water Master Plan proposes building a new Belmont Plant and as such a pilot plant would be set up for any changes proposed.

The remnants from Hurricane/Tropical Storm Ida impacted the Belmont Raw Water Pump Station when the Schuylkill River rose to near record levels. The Belmont Raw Water Pump Station had construction in progress under a betterment contract (Capital Contract 64071). The Water Department is still assessing damage to its facilities, but it expects at approximately $2.3 million in repairs. Other damages are falling to the responsibility of the contractor or other parties. The Water Department anticipated spending approximately $600,000 from operations for emergency repairs to two pump motors that were damaged as part of the flooding, and rental costs for additional recovery equipment, including temporary high voltage switchgear. Monthly costs for continued rental of equipment are roughly $69,000 per month and may continue for several additional months until equipment is returned to service. After the storm, pumping from this station at reduced capacity was available within 7 days, and while the Belmont Plant was taken offline due to the storm, it was back in service on September 11, 2021, approximately 10 days after the damage occurred to the raw water pump station which feeds water from the Schuylkill River for treatment. Due to multiple treatment facilities (Belmont, Queen Lane, and Baxter water treatment plants) that can provide redundant service, the Water Department was able to maintain uninterrupted service to the City and bulk customers. Based on the unprecedented events encountered during the Ida event, the Water Department is reassessing needs for flood protection and improved resiliency in the future and include updates to their Standard Operating Procedures.

The following are major projects recently completed at the Belmont Plant (Work No. included in parentheses for contracted projects):

- (62118) Caustic tank recirculation system with capability to allow for draining of individual tanks
- (62130) North filter gallery catwalk replacement expected completion in FY 2021.

The following major projects are ongoing at the Belmont Plant:

- (60008) Preliminary work for major security upgrades, installation of security lighting and cameras, new facility entrance access control, fencing, access card system, cameras, and portal hardening, is expected to be completed in FY 2022.
- (62112) Rehabilitation of flocculation/sedimentation basins. There are 4 basins, three are currently complete with the fourth anticipated to be in service November 2022. The project is expected to be completed FY 2022.
- (62123) Sodium hypochlorite loop and dosing system replacement project is 60% complete. This project includes replacement of piping and underground dosing lines directly to the point of connection.
- (62124) Sodium hypochlorite tank mixing upgrades reached substantial completion in August 2021 with minor punchlist items remaining. The project is expected to be complete in FY 2022.
- (62127) Backwash pump replacement. One of the two pumps is ready for start-up, expected project completion in FY2022.
- (62128) Replacement Filter Building HVAC has minor punchlist items remaining.
- (62133) Rehabilitation of nine filters with new media, underdrains, and concrete repairs expected to be completed in FY 2022. Currently 4 of the 9 filters are complete, filters 5&6 are under construction. At project completion a total of thirteen filters will be rehabilitated sin FY 2018, this represents half of the total filters. The remaining filters will be rehabilitated in future fiscal years.
- (62127) Replacement of Washwater Pumps and Motors is in construction
- (62138) Sodium hydroxide tank industrial coating replacement is in construction two tanks are anticipated to be complete this winter.

Major projects in Projects Control pipeline include:

- (62105) Carbon mixers and dust collection system replacement
- (62129) Replacement of Combined Filter Effluent (CFE) sluice gates and rapid mix isolation valves.
- (62134) Filter building dehumidifier replacement
- (62143) Structural embankment betterment is Bidding.
- (62144) Replacement Filter Building windows.

Major projects in Design include:

- (62139) Rehabilitation of the remaining thirteen filters with new media, underdrain, and concrete repairs
- (62146) Installation of Airwash System for Backwashing 26 Filters will follow filter rehabilitation efforts.
- (62152) Backwash tower betterment and improvements.

As part of the long-range Master Plan, it is anticipated that a future project at the Belmont Water Treatment Plant will include the construction of new facilities at Belmont to essentially provide a new water treatment plant that can operate alongside the existing Belmont Plant. This would be utilized throughout the duration of contracts envisioned to build a new Queen Lane Plant.

4.5 Storage and Pumping Facilities

As noted above, the Water Department uses the Belmont, Baxter, and Queen Lane treatment plants to produce water for the system. The delivery of the finished water to customers is accomplished using several key assets that discussed below.

The major reservoir storage facilities and their current capacities consist of:

- East Park 90.0 MG
- Oak Lane 72.8 MG
- Roxborough (Upper and Lower) 28.5 MG

The Water Department maintains additional distribution storage that is available for meeting peak customer and public fire service demands. Distribution storage consists of the Fox Chase elevated storage tank (1.5 MG); the two Somerton standpipes (10 MG); and the two Roxborough standpipes (11 MG) which provide a total of 22.5 MG of distribution system storage.

In December 2019, the Water Department has placed all three 30 MG concrete storage tanks in service at the East Park facility. The project replaced the old reservoir configuration, with three separate tanks to provide additional flexibility and redundancy for operations.

The major pumping facilities are presented in Table 4-9 by their respective division and consist of both raw water and finished water pump stations. The divisions reflect the general source of supply and treatment facilities that supply the pump stations.

Table 4-9. Water System Pumping Stations

Delaware Division	Schuylkill Division
East Oak Lane	Belmont High Service
Fox Chase Booster	Belmont Raw Water
Lardner's Point	Chestnut Hill
Torresdale Low Service	East Park Booster
Torresdale High Service	Queen Lane High Service
Torresdale Raw Water	Queen Lane to Roxborough
West Oak Lane	Queen Lane Raw Water
	Roxborough High Service
	Navy Pumping Station

As noted above, the recent master planning process took into account the current and future needs of the storage and pumping facilities. The master plan has identified several improvements to existing facilities that are planned to be completed in the near future, including:

- Torresdale Pump Station Rehabilitation – Construction has started March 2, 2021 to update aging, critical infrastructure, while providing enhanced redundancy. This includes work numbers 64093, 64117, 64118 and 64119. This project is to be funded via a Pennvest Loan as further described in Section 2.0 of this Report.
- Lardner's Point Pump Station Reconstruction - Update to aging, critical infrastructure, while providing enhanced redundancy. The contract for the design of this project was issued December 2020 and includes work numbers 64086, 64087, 64088 and 64089.
- Fox Chase Pump Station – Improvements to transmission mains adjacent to the pump station to enhance supply and redundancy is in Design.
- Somerton Tank Transmission – Improvements to the transmission mains adjacent to the Somerton storage tank to enhance long-term regulatory compliance and water quality is in Design.
- Roxborough High Service Pump Station Betterment – (64112) has been transmitted to Design.
- Other Capital Upgrades
    - Belmont Raw Water Pump Station and emergency generator upgrades work number 64071 was substantially completed on November 3, 2020. This station flooded for the first time ever during Hurricane Ida on September 2, 2021 causing damage to the station.
    - The East Park Booster Pump Station Betterment work number 64084, was at the 30% design level as of May 14, 2021.
    - George's Hill Pump Station (64111) will be a redundant supply to the Belmont High service pressure district design and is underway. Pumps at Belmont will match the pump size for George's Hill.
    - HVAC replacement at Torresdale Finished Water (TFW) Pump Station and Torresdale Raw Water (TRW) Pump Station are both substantially complete. (TRW work number 64097 was substantially complete as of November 20, 2020 and TFW work number 64094 as of July 22, 2021).
    - Chestnut Hill Pump Station Betterment work number 64099 is in Design.
    - Queen Lane Raw Water PS emergency generator, partial electrical and partial mechanical rehab at 60% Design 03/04/2021. (64090) This partial station rehabilitation is intended to bridge the gap until the Water Master Plan recommends moving forward with the entire station betterment.
    - (64076) West Oak Lane Pumping Station Rehabilitation complete electrical and mechanical overhaul of the station including an emergency generator is about 92% complete.
    - East Oak Lane Pumping Station Betterment – (64083) mechanical overhaul, building structure evaluation, piping evaluation, replace all doors, windows, HVAC – in Design.

- Queen Lane Filtered Water Pumping Station Emergency Generator Addition – (64090) in Design. The generator will provide enhanced reliability to the RE and QLHS Districts.

Other improvements are scheduled to be completed over the 25-year master plan timeline via phased implementation.

4.6 Water Conveyance Operations

The Water Conveyance unit is focused on the provision of drinking water to the Water Department's customers via transmission, distribution, and pumping assets. This unit works to provide drinking water at superior quality and pressures to meet customer demands. Additionally, the unit performs functions related to customer disconnection and reconnections. Water Conveyance operates via the Distribution, Pumping, and Load Control units which are described in the following sections.

4.6.1 Distribution Unit

The Distribution Unit focuses on maintaining the integrity of the distribution system. This includes surveying mains for leaks, repairing breaks, assuring fire hydrants operate properly and are available for fire protection, and performing customer connection or disconnection jobs. The Water Department tracks the performance of the Distribution Unit in several key areas as reflected in Table 4-10 for the last five fiscal years.

Table 4-10. Repair Record

Service Parameter	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Breaks Repaired	715	984	778	612	772
Discontinuance Orders Completed	387	311	220	274	280
Valves Repaired	66	56	40	62	38
Connections	88	88	101	103	145
Leak Survey (miles of pipeline)	1,053	742	747	796	803
Hydrants Repaired	3,077	2,584[1]	1,032	3,558	5,113

Source: PWD Cityworks® Report No. 510 used for all data except main breaks. Main breaks data taken from 58-Year Main Break trend report.

[1] The Water Department notes that the FY 2018 number of hydrants repaired seen in the Table above may be inaccurate due to a clerical issue. The hydrant availability rate for FY 2019, FY 2020, and FY 2021 was 99.4%, 99.2%, and 98.9%, respectively reflecting strong availability.

The break rate has averaged 238 breaks/1,000 miles over the past five fiscal years. As shown in Figure 4-2., the Water Department's break rate has been relatively flat over the past 20 years. Compared to similarly large utilities, the Water Department's break rate is currently higher than that of New York City (~64/1,000 miles), but lower than WSSC (~340/1,000 miles) and DC Water (~235/1,000 miles). A preventive maintenance program that involves both field investigations, as well as systematic scheduling of repairs and replacements is in place for the pipeline infrastructure. The Distribution Unit conducts leak

surveys, examinations of portions of repaired mains to determine if corrosion played a role in a main break failure, and corrosion control studies as part of the preventative maintenance program.

The Distribution Unit also tracks distribution system valves to ensure that they are properly maintained, repaired, or replaced to ensure they perform as expected to manage and control the delivery of water. According to the June 30, 2021 Monthly Manager's Report, the distribution system has approximately 93,580 valves – 3,037 miles of main (3,178 when including raw water lines) – 25,202 hydrants which are tracked by this unit. Table 4-11 below summarizes the valve maintenance program for FY 2021.

Difficulties in filling vacancies has impacted scheduling of work activities. The Distribution Unit staffing level authorized is 268. Currently there are 18 vacant positions and 28 employees in IOD status, resulting in staffing at 83% of the authorized level. Emergency repairs are prioritized and managed effectively, but other proactive efforts have decreased. The staffing level for this unit continues to negatively impact scheduling of non-emergency work.

Table 4-11. FY 2021 Valve Maintenance

Valves	Total	Distribution	Transmission	Raw
Operated	14,478	11,908	2,554	16
Found defective	49	32	15	2
Repairs	38			

Source: PWD Cityworks® Reports #403 and #510

4.6.2 Pumping Unit

The Pumping Unit is responsible for operating and maintaining the Water Department's drinking water pumping stations. It also is responsible for maintaining distribution system finished water storage reservoirs and standpipes. A key metric for this unit is availability of pumping assets to provide service. The Water Department provided the following metrics seen in Table 4-12.

Table 4-12. Pumping Unit Activity

Performance Measure	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
% Pump Availability	90.3	92.3	92.3	94.2	95.2
% Station Efficiency (wire to water)	76.7	77.5	77.4	78.2	78.3
% Planned Work (a productivity measurement)	96.3	97.6	94.2	95.6	96.5

Source: FY 2017 and FY 2018 based on the Water Department's Monthly Manager's Report for period ending June 30, 2018. FY 2019, FY 2020, and FY 2021 from Monthly manager reports for periods ending June 30, 2019, 2020, and 2021, respectively.

As is shown, pump availability has remained at over 90 percent for the last several years, indicating a proactive approach to maintenance and readiness. This proactive approach is also reflected in the percentage of planned work conducted as opposed to reactive maintenance. The percentage of station

efficiency measures the relationship between electrical input and mechanical output for the station pumps and provides the unit with a measure of efficiency. This metric has also remained stable for the last several years, which is commendable given the average age of the pumping equipment is more than 60 years old.

4.6.3 Load Control Unit

The Load Control Unit manages the hydraulic delivery of finished drinking water to its customers. This includes conducting planning through the use of a water system-wide hydraulic model that allows the unit to estimate the impact of operational changes or changes to facility assets. The information from this unit is used in planning initiatives such as the Drinking Water Master Plan and planning for capital projects.

This unit utilizes the SCADA system to control the delivery of water to customers. The unit seeks to find the most efficient delivery method that limits the use of electricity, including the management of storage levels to minimize pump usage during peak periods where electricity is more expensive. Table 4-13 presents the metrics used by the unit to measure its annual performance.

Table 4-13. Load Control Unit – Water Conveyance Unit Electrical Demand

Performance Measure	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Average Daily Delivered Water, mgd	223.1	223.2	221.8	220.5	225.3
Total Power Consumption, million kilowatt-hours	109.6	113.0	114.1	112.9	114.7
Total Peak Billing Demand, kW	160,109	154,008	141,843	148,370	150,602
Total Expenditures for Power	$6,691,036	$6,028,366	$5,958,171	$6,077,364	$5,937,623
Cost per million gallons pumped (raw & treated water)	$82.20	$74.00	$73.60	$75.31	$70.44

Source: Load Control Unit Annual Report. FY 2021 data from staff interview.

The metrics show that the Water Department has been able to achieve a consistent delivery of water to its customers at a relatively stable price. The overall amount of water delivered decreased slightly to FY 2020 but shows a pickup in FY 2021.

4.7 Operations Administration

The Operations Administration unit coordinates the various field services activities of the Water Department. This includes responding to customer water and sewer issues, managing and maintaining customer meters, performing water shut off and turn on as required, and other distribution and collection system activities.

The unit relies on the Cityworks® maintenance management system to track and record the completion of its various customer and service work orders. Cityworks® incorporates the Water Department's street side assets for the water and sewer systems and provides for coordination of service requests between the call center and field services staff. The maintenance management system is a useful tool that provides

managers with the ability to track service requests and provide a more proactive approach for responding to maintenance issues and customer complaints.

The following sections provide an overview of several key units and initiatives within Operations Administration.

4.7.1 Meters

Water meters are critical assets for all utilities as they provide the means for accurately billing and collecting revenue from customers. The Meter Shop unit manages the maintenance and replacement of approximately 486,000 meters across its service area. Key aspects of meter management include:

- Testing – Meters are regularly tested to ensure that they record within acceptable accuracy parameters
- Replacement – Faulty meters are removed and replaced, and large-sized meters (greater than 1- inch), which measure a significant amount of the Water Department's billed usage, are replaced on a regular basis to ensure a greater level of accuracy.
- Automatic Meter Reading (AMR) – The Water Department currently uses AMR equipment which includes Encoder Receiver Transmitter (ERT) equipment and associated batteries. AMR allows for the transmission of meter reads to an adjacent receiver in lieu of having staff physically access, read the meter, and transcribe the results for billing. The Meter Shop unit is responsible for maintenance and replacement of this equipment.
- Sizing – The Meter Shop unit analyzes the usage and operations of commercial and industrial customers. As necessary, meters are changed to better align the meter size with customer usage. This improves the accuracy of recorded data for these customers.

The Water Department is currently in the process of converting its metering system to Advanced Metering Infrastructure (AMI) and has added a new AMI team for this project, including four engineers to implement and manage the AMI project. The Water Department has entered into a 20-year contract with Sensus that began in March of 2021. This AMI implementation contract was to include the replacement and installation of residential radio units over a 2-year period; however, the Pandemic and global microchip shortage has resulted in delays in full implementation of the contract. It was originally estimated the Sensus would be able to install 5,000 units per week; however, Sensus is currently averaging approximately 1,500 units per week due to limited availability of units to be installed. The shortfall in equipment availability is projected to continue through the second quarter of calendar year 2022, and the proposed implementation period is now anticipated to last approximately three years.

At the time of this Report, the Water Department notes that the AMI network that receives and transmits data from the customer radio units is complete. Sensus is performing the majority of installation of radio units for most of the residential properties, and the meter shop is addressing any radio units for the commercial and industrial properties. Additionally, if meters need to be replaced, then the meter shop is performing these replacements. To date, the meter shop has installed approximately 9,500 units at commercial or industrial properties and 28,000 units at residential properties. Through October 25, 2021, Sensus has installed approximately 56,000 residential units, and current total radio unit implementation completion is at approximately 20 percent. The Water Department will also install tamper-proof equipment

on certain meters that have been flagged, as well as a remote shut-off valve to allow for a quick response to identified instances of tampering.

AMI will allow for regular, consistent transmission of meter data to a Meter Data Management System that will allow the Water Department and customers real-time access to customer water usage data. AMI is being implemented system-wide and will provide certain benefits including, identification of customers with leaking plumbing; better understanding if meter tampering is occurring; and a better understanding of customer usage by specific area, which can help narrow areas of the distribution system where significant leakage may be occurring.

4.7.2 Revenue Protection

With a large number of customer accounts across its system, the Water Department experiences ongoing instances of tampering and unauthorized usage, as well as account delinquencies due to inability to pay. These instances result in lost revenue. Pre-Pandemic the Water Department had taken a proactive approach to identifying instances where shut offs need to occur to facilitate payment and revenue recovery. Due to the Pandemic, there has been a moratorium on shut offs of residential customers for non-payment. The Water Department notes that the current shut-off policy generally consists of the following:

- Moratorium on residential shut offs for non-payment due to the Pandemic. Shut offs for non-payment for residential customers is supposed to resume in April of 2022.
- Shut offs for non-payment for non-residential customers resumed as of October 25, 2021. As of November 22, 2021 the Water Department notes that approximately 976 of these customers have now been shut-off.
- Shut offs related to notice of defects, e.g., plumbing issues that could damage property or contaminate the water system have continued for all customers irrespective of the Pandemic.
- Metering non-compliance. These are shut offs for failure to allow the Water Department access to homes or businesses to change out meters or meter radio equipment. In these instances, residential customers are allowed to request a deferral of the changeout due to the Pandemic.

With the moratorium for residential shut offs related to payment delinquencies still in place, the ability for the Water Department to recover outstanding revenue continues to be delayed.

Working in concert with WRB, the Water Department tracks the estimated amount of water billings that are recovered due to its activities of identifying and correcting instances of unauthorized usage or delinquencies. Table 4-14 presents the estimated recovered billings for FY 2017 through FY 2021. The table shows that pre-Pandemic, approximately $4.5 million per year in billings were typically recovered due to their efforts. The recovered billings for FY 2020 and FY 2021 were significantly decreased due to the shut off moratorium in place due to the Pandemic. The last time shut offs for residential delinquencies were made was on November 30, 2019. In addition to the moratorium on shut offs, any residential delinquencies that were turned off pre-Pandemic, were turned on for health and safety of the public. This represents approximately 20,000 accounts that were delinquent but placed back into service, further compounding the delay in revenue recovery. The moratorium on residential shutoffs for non-payment is to remain in place through April of 2022, resulting in the anticipated recovered billings to remain relatively lower for much of FY 2022.

Without a need to shut off services, much of the workforce that performed these tasks were temporarily reassigned to other units (mainly distribution). The previously reassigned staff are now starting to return to the Operations Administration unit. On July 1, 2021, the Operations Administration unit returned to shutting off due non-compliance with meter changeout program to help facilitate the implementation of the AMI system.

As noted above, the implementation of AMI will help the Water Department better identify unauthorized usage and quickly shut-off service. This should help enhance the current process and result in better revenue recovery once the full AMI system is operational and the shut-off restrictions related to the Pandemic are lifted.

Table 4-14. Water Department and Water Revenue Bureau Annual Water Audit Summary

Fiscal Year	Water Recovered, mgd	Recovered Billings
2017	3.10	$4,976,896
2018	2.81	$4,507,116
2019	2.79	$4,468,453
2020	1.64	$2,627,137
2021	1.57	$2,525,647

Operations Administration's ongoing activities continue to build on past efforts. Future program initiatives include:

- Utilize the full potential of the billing system to enhance the management of customer account data. Online payment application Kubra© includes the ability to give customers hourly, daily, or weekly meter reads, leakage reports, or zero use reports if the customer opts in to receive these notifications.
- Increase staff levels to enhance revenue collections.
- Identify opportunities to improve efficiency and timeliness in addressing leakage on customer services connection piping. The Water Department is actively sending notifications if customers opt-in.
- Continue to leverage the Cityworks® maintenance management system to better track leak occurrences, pipeline failure modes, and response and repair times. The Department has retained a consulting firm to help improve the utilization of Cityworks®.
- Establish a process to reliably track the period when leaks are identified to the completion of repairs and improve practices to minimize this lag period.
- Investigate opportunities for additional DMAs with enhanced pressure management capabilities.
- The Water Department has been working with Tyler Technologies to replace their outdated permitting application process for new water and sewer service applications. Tyler Technologies has provided a digital solution which will allow online payments and the retirement of legacy systems. This system will allow greater transparency across all City departments, so that all departments can see where the

permit is in the process for approvals and include generation of work orders in Cityworks. Permittees can also access the system to track the progress of their applications.

4.8 Backflow Compliance

The Backflow Compliance group sits within the Industrial Waste & Backflow Compliance unit and is responsible for enforcement of the Water Department's Regulation 403 (which requires adequate backflow protection for any connections to the water system) and Cross Connection Control Program to prevent the backflow of contaminants into the potable water system. This group is also responsible for public education regarding prevention of backflows and cross connections, inspection of backflow preventers, and tracking of backflow preventer third-party inspection reports.

This group provides useful information to the public via a website that includes a list of approved backflow prevention assemblies, a list of certified backflow prevention technicians, cross-connection prevention information for homeowners, frequently asked questions, and various other useful and related documents.

4.9 Conclusions

Based upon our site visits to each of the treatment facilities, discussions with Water Department personnel, and our experience with other water utilities, we find the general condition of these major water facilities to be in good condition, or adequate steps are being taken to return the facilities to good condition. The Water Department is able to provide reliable levels of service and meet regulatory requirements due to its proactive approach to operations and maintenance. The Water Department regularly reviews its capital improvement needs and prioritizes to maintain compliance. Currently, it is in the process of planning and designing significant projects from its Drinking Water Master Plan to rehabilitate major facilities that have been in service for many years. Based on our observations during our site visits and discussions with staff, maintenance of facilities appears adequate to sustain equipment in reliable working order.

The ongoing Pandemic has impacted the Water Department's operations; however, it has continued to provide quality water to customers under difficult circumstances. The Pandemic has delayed several initiatives, including the revenue protection program, water main replacement, and implementation of some capital projects. As the Water Department is returning to a full work schedule, and as the Pandemic abates over the coming years, Arcadis anticipates that the Water Department's performance on these initiatives will return to pre-Pandemic levels.

During our interviews, Water Department staff noted that filling vacant positions has become more challenging in recent years. The challenges include finding qualified individuals to fill positions, as well as using the City's overall hiring process, which can be relatively time-consuming to navigate. There has also been turnover of mid to senior level managers as the workforce ages and approaches retirement age, as well as annual increases in the number of paid days lost. Arcadis recommends that the Water Department pay particular attention to staffing issues to ensure that critical management and maintenance activities continue into the future.

5 WASTEWATER SYSTEM

5.1 Overview of Service Area

Figure 5-1 on the following page provides a general overview of the Water Department's wastewater system. The overall system is separated into three distinct areas, including the Northeast, Southeast, and Southwest service areas. Wastewater volumes for each of these areas is collected and conveyed to a major treatment plant that is owned and operated by the Water Department. The Water Department serves the residents of the City on a retail basis and also provides wholesale services via 10 wholesale wastewater service agreements executed by the City. Based on the 2020 U.S. Census estimate, the Water Department estimates that it serves approximately 1.6 million persons within Philadelphia County. The service area consists of 364 square miles. The wastewater system includes approximately:

- 3,718 miles of total collector system piping (including force mains)
- 17 wastewater pumping stations (includes 1 owned by police department)
- 3 stormwater pumping stations (includes 2 owned by PennDOT)
- 94,530 manholes
- 26 storm relief chambers
- 174 combined sewer regulating chambers
- 71,431 stormwater inlets

Approximately 55 percent of the collection system consists of combined sanitary/stormwater mains.

The Water Department provides wholesale wastewater service to the following municipalities, authorities, and Aqua Wastewater LLC. The wholesale volumes in million gallons for FY 2021 are reflected in parentheses.

- Abington (715)
- Bucks County Water & Sewer Authority (BCWSA)
    - BCWSA (6,722)
    - BCWSA Bensalem (1,089)
    - BCWSA Springfield (947)
- Aqua Pennsylvania Wastewater, Inc. (Cheltenham) (3,119)
- DELCORA (8,690)
- Lower Merion (2,418)
- Lower Moreland (461)
- Lower Southampton (2,031)

- Upper Darby (3,597)

The flow from these wholesale customers comprises approximately 17.5 percent of the wastewater volumes treated at the Water Department's three treatment plants. Annual revenue from these customers in included in Section 2 of this Report and is approximately 5.5% of the Water Department's operating revenue.

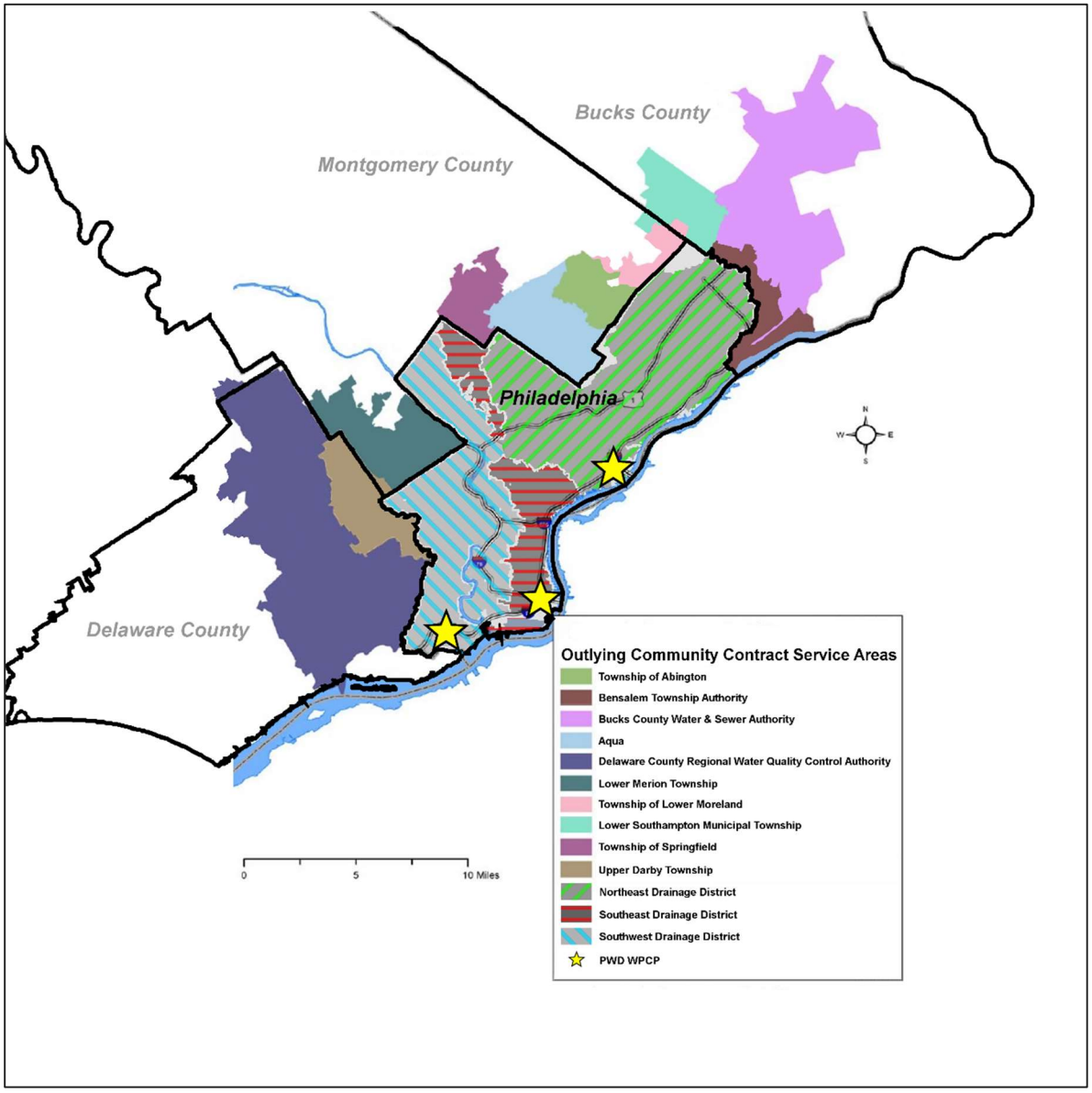

Figure 5-1. Overview Map of Wastewater Service Areas

5.2 Relevant Regulatory Permits and Obligations

The following sections provide an overview of Arcadis' review of the Water Department's major regulatory obligations.

5.2.1 Consent Order & Agreement

Arcadis reviewed the COA between the City and PADEP. The City entered into the COA with PADEP in 2011 and an Administrative Order for Compliance on Consent with the USEPA in 2012. The COA requires the Water Department to implement the Long-Term Control Plan Update, also known as the Green City, Clean Waters (GCCW) program, and provide annual reporting on progress. One of the goals of the GCCW program is to remove an equivalent mass of pollutants (BOD, Total Suspended Solids, and fecal coliform bacteria) to an alternative consisting of satellite primary clarifiers with disinfection that controls 85% of the wet weather flow by volume, this goal is monitored through performance standards that are required to be met every 5 years of the program. The COA also requires the submittal of an Evaluation and Adaptation Plan (EAP) at least once every five years. The EAP includes an assessment of progress made, description of program elements for the upcoming 5-year period, and adaptive strategies for any performance standards that are not met. In the 2016 EAP, the Water Department reported that it had met or exceeded all of the 5-year performance standards. The performance standards of the COA are shown below in Table 5-1.

As noted above in the Key Initiatives section, the Water Department provided PADEP with a letter notifying it that a Force Majeure event has occurred related to the Pandemic. The Pandemic significantly impacted the Water Department's operations and caused a delay in its rate case. Citing force majeure, the City requested and on April 6, 2021, the PADEP formally granted, an extension for the City to complete the Ten-Year Performance Standard requirements and other deliverables. The PADEP granted the City an extension until December 31, 2021 to achieve the Ten-Year water quality based effluent limit performance standards, and until May 30, 2022 to deliver the Year 10 EAP.

Table 5-1. COA Performance Standards

Metric	Units	Baseline value	Cumulative amount as of Year 5	Cumulative amount as of Year 10	Cumulative amount as of Year 15	Cumulative amount as of Year 20	Cumulative amount as of Year 25
[plant name] WPCP upgrade: Design	percent complete	0	see note (1)	see note (1)	see note (1)	100%	100%
[plant name] WPCP upgrade: Construction	percent complete	0	see note (1)	see note (1)	see note (1)	100%	100%
Miles of Interceptor Lined	miles	0	2	6	14.5	14.5	14.5
Overflow Reduction Volume (2)	million gallons per year	0	600	2,044	3,619	5,985	7,960
Total Greened Acres	Greened Acres	0	744	2,148	3,812	6,424	9,564
Equivalent Mass Capture - TSS	percent	62%	Report value	Report value	Report value	Report value	85%
Equivalent Mass Capture - BOD_5	percent	62%	Report value	Report value	Report value	Report value	85%
Equivalent Mass Capture - Coliform Bacteria	percent	62%	Report value	Report value	Report value	Report value	85%

(1) Performance Standards for "percent complete" for the WPCP upgrade design and construction projects were not available at the time of the COA. The City shall provide these targets to the PADEP along with the Facility Concept Plan for the WPCP. The Facility Concept Plan is due on a specific date given in the COA. After the PADEP approves the Facility Concept Plan, the targets for "percent complete" will be entered into COA Table 1. The formal modification of COA Table 1 may be accomplished by the PADEP by issuing a revised NPDES permit.

(2) Overflow Reduction Volume means the difference between the volume of overflow in million gallons per year for the condition prevailing at the time of the report and the volume of overflow in million gallons per year for the baseline year. The baseline year is represented by Philadelphia's physical systems as they were configured on January 1, 2006. Both volumes will be determined from modeling, using climatic data representing the same "typical year" for Philadelphia as determined in the LTCPU development process, and a hydrologic/hydraulic model calibrated with flow data collected for verification of actual performance.

As shown in Table 5-1, the GCCW program relies on a combination of interceptor lining, WPCP upgrades, implementing 9,564 greened acres and reducing annual combined sewer overflow volume by 7.96 billion gallons over a 25-year period. A greened acre is described as an acre of impervious cover connected (tributary) to a combined sewer that subsequently is reconfigured to utilize green stormwater infrastructure to manage at least one inch of stormwater runoff. As of December 1, 2021, there have

been 2,202 Greened Acres (GAs) implemented under this program (701 acres on public property, 696 acres associated with private development or redevelopment, and 805 GAs through incentivized retrofits on private property). A final accounting of greened acres towards the Year 10 performance standard will be completed and reported in the Year 10 EAP. The Water Department currently has $20 million budgeted in FY 2022 and $73 million in FY 2023 for construction of green infrastructure that will be within the public right-of-way. Other, future greened acres will be achieved through retrofits and redevelopment of private property.

The COA includes penalties for failing to achieve the Water Quality-Based Effluent Limits (WQBEL) performance standards outlined above. The penalties range from $25,000 per month per violation for the first six months; $50,000 per month per violation for months 7 through 12; and $100,000 per month per violation for the thirteenth month and beyond. There are also penalties for failing to submit timely reports as required that range from $1,500 per day per violation to $2,500 per day per violation.

The Water Department's proposed FY 2023 through FY 2028 CIP includes significant capital expenditures on projects to implement the LTCPU and comply with the COA. The Water Department's current estimates are that the 25-year program will cost a total of $4.5 billion, including $3.5 billion of capital expenditures and $1.0 billion of O&M expenditures. The proposed CIP for FY 2023 through FY 2028 includes average annual capital expenditures of approximately $138M (uninflated) associated with the COA and CSO elimination. Through the EAP process, the Water Department will continue to evaluate its strategy for compliance with the COA in a cost-effective manner. The COA includes provisions that should the cost of implementing the LTCPU exceed 2.27% of the median household income, the Water Department may request a modification to the implementation schedule.

The Water Department met with the USEPA in June 2018 to discuss an information request to analyze the controls necessary to achieve 85 percent mass capture in each WPCP drainage district. The information request was stayed and there has been minimal dialogue on the topic until a 2020 inquiry on the matter by the PADEP. It is anticipated that if further discussions are necessary, they will be held under the negotiation of upcoming NPDES CSO Permits.

5.2.2 National Pollutant Discharge Elimination System Permits and Compliance

The NPDES permits for the Northeast, Southeast, and Southwest WPCPs became effective in September of 2007 and expired five years later in August of 2012. The Water Department notes that it submitted a renewal application that has been certified by PADEP as administratively complete. It continues to operate under the parameters of the NPDES permits and is in the process of reviewing and revising draft versions of proposed NPDES permits with PADEP. The Water Department notes that the elements of the negotiated COA are included in the draft NPDES permits.

The NPDES permits regulate the discharges and associated collection systems of these three WPCPs. The following table presents the main monthly discharge limits currently applicable to the Water Department.

Table 5-2. Average Monthly NPDES Permit Effluent Discharge Limitations

Description	Northeast WPCP	Southeast WPCP	Southwest WPCP
$CBOD_5$ (mg/l)	25		25
$CBOD_5$ (lbs./day)	36,430		19,800
$CBOD_5$ % Removal [1]	>= 86		>= 89.25
BOD_5 (mg/l)		30	
BOD_5 (lbs./day)		19,650	
BOD_5 % Removal [2]		>= 86	
TSS (mg/l)	30	30	30
TSS (lbs./day)	52,540	28,025	50,400
TSS % Removal [3]	>= 85	>= 85	>= 85
Fecal Coliform (# / ml)	200	200	200

[1] Also use these values for days when daily flow exceeds the WPCPs maximum daily flow capacity for calculating $CBOD_5$ average monthly percent removal.

[2] Also use these values for days when daily flow exceeds the WPCP maximum daily flow capacity for calculating BOD_5 average monthly percent removal.

[3] Also use these values for days when daily flow exceeds the WPCPs maximum daily flow capacity for calculating TSS average monthly percent removal.

Based on Arcadis' experience, the above effluent discharge limits are common for wastewater treatment facilities in the industry. It is noted that the NPDES permits for each WPCP also include monitoring and reporting requirements for several other parameters including total phosphorous, nitrogen parameters (ammonia, nitrate, nitrite), and other parameters that could be of concern.

Through discussions with plant personnel, we were informed that the only plant NPDES permit exceedance during FY 2021 was a Carbonaceous Biochemical Oxygen Demand (CBOD20) exceedance at the Southwest plant that occurred on August 5, 2020 during a wet weather event.

In addition, Arcadis reviewed the EPA Enforcement and Compliance History Online (ECHO) database, and it was noted that each wastewater facility had a few single event violations for "wastewater – sanitary sewer overflow discharge to waters". These events are typically related to blockages, or other failures, in the sanitary sewer system that result in a wastewater discharge to waters of the United States. Other violations noted on the ECHO site were for the following:

- The Southeast WPCP received a wastewater CSO violation for failure to implement required Nine Minimum Controls (NMC) #1 (Proper operation and maintenance).
- The Northeast WPCP received a clean air act violation for nitrogen oxides on January 22, 2021. This was the only clean air act violation over the past 2 fiscal years.

From an industry perspective, the three WPCPs have achieved high levels of treatment efficiency and have been recognized by the National Association of Clean Water Agencies (NACWA) with either Silver, Gold, or Platinum awards over the past decades. In 2020 the Northeast WPCP received the Gold award, and the Southeast WPCP received its 21st NACWA platinum award. The platinum award is given to facilities that are in complete compliance with NPDES requirements for five consecutive calendar years. The Southwest WPCP did not receive an award from NACWA during calendar year 2020 due to the violations in calendar year 2020 described above.

The NPDES permits also include requirements related to reporting and monitoring stormwater outfalls, as well as managing a pretreatment program to monitor and regulate significant industrial users that have the potential to discharge significant strength wastewater that could upset the normal operation of the WPCPs.

5.2.3 Municipal Separate Storm Sewer System Permit

The Water Department's separate storm sewer system is regulated as a large MS4 under PADEP's MS4 program. The Water Department is currently operating under a 2005 MS4 permit (which expired in 2010) and continue to implement the elements of the expired permit. An annual report includes progress towards reducing sediment load in the Wissahickon Creek, minimizing PCBs in the MS4, watershed monitoring, identification and abatement of illicit discharges, monitoring and control of pollutants from industrial sources and construction sites, public education and implementation of various stormwater best management practices. The Water Department and PADEP have been in regular contact regarding the most recent pre-draft version of an MS4 permit since late 2019. The PADEP has indicated that the MS4 permit could include a requirement for a pollutant reduction plan with 10 percent sediment reduction from the baseline loading and other provisions that could increase the cost to comply with the permit. The Water Department is still in the process of negotiating the new permit with PADEP and the overall timing and magnitude of any potential additional costs is not known.

5.2.4 Title V Major Source Operating Permits

The Northeast WPCP and the BRC are currently regulated under Title V Permits as major sources of emissions of VOCs and nitrogen oxides. The Southeast WPCP does not have a Title V air permit because its sludge is pumped to the Southwest WPCP for treatment.

In January 2013, the Water Department entered into a Title V consent order agreement to address odor issues from the Northeast WPCP by installing gravity thickeners and related odor control. The gravity thickeners were completed in 2019 and are operational. An amended Title V air permit for the Northeast WPCP was submitted in May 2020 and awaiting approval.

Effective March 4, 2019 the Southwest WPCP's air permit designation was reduced to a synthetic minor because Philadelphia Biosolids Services, LLC (PBS) is responsible for operation of the BRC. The BRC continues to have a Title V air permit separate from the Southwest WPCP.

Since 2008, no odor violations have been reported at the Northeast WPCP, Southeast WPCP, or Southwest WPCP.

5.3 Wastewater System Initiatives

5.3.1 Wastewater Master Planning

The Water Department completed a draft Wastewater System Master Plan in 2016. The purpose of the plan was fourfold:

- Wet Weather – Develop a plan for wet weather capacity improvements that may be needed to comply with the CSO Long Term Control Plan Update
- Asset Replacement – Determine the need for asset replacement at the three wastewater treatment plants and for nonlinear assets in the collection system
- Regulatory Compliance – Develop strategies to plan for potential future regulatory requirements
- Utility of the Future – Develop strategies for improving efficiency, investigating resource recovery and creating resilient wastewater facilities

The long-range Wastewater Master Plan (2016) was intended to serve as a broad adaptive road map to anticipate and plan for the City's future wastewater system needs. The Wastewater Master Plan (2016) incorporated elements of the COA and LTCPU that were previously agreed to with PADEP as well as forward looking objectives. The plan was divided into five components:

1. Understanding and analyzing the Water Department's basic data
2. Evaluating wet weather capacity improvements
3. Preparing for asset replacement
4. Planning for potential future regulations
5. Moving towards the utility of the future

The Water Department summarized the Wastewater Master Plan (2016) as achieving the following goals:

- Determined that no expansion of the existing WPCP and collection system facilities are required to meet the projected dry weather needs through 2066.
- Identified strategies using a combination of green and traditional (gray) infrastructure that may be needed to accommodate additional wet weather flows.
- Identified when wastewater treatment plant assets may need to be replaced and determined planning level capital replacement costs.
- Considered future and potential regulatory requirements.

Estimated costs for the replacement of assets were developed and the document considered the impacts and costs for potential future regulatory concerns (i.e., GHG emissions, nutrient pollution and wet weather). Costs developed in the Wastewater Master Plan help to shape the budget for capital improvements that are incorporated into the Water Department's overall CIP.

The plan is a living document that the Water Department utilizes to assist in their decision-making process and is updated every five years, or sooner if a trigger scenario has occurred (changes to population, regulatory environment, etc.). In 2020, the Water Department has awarded a contract to prepare an update to the Wastewater Master Plan, and the update work is underway.

5.4 Northeast WPCP

As seen in Figure 5-1, the Northeast WPCP serves northeast Philadelphia and suburban areas in southeast Bucks and eastern Montgomery counties. The Northeast WPCP is designed to handle an average day flow of 210 mgd and a peak flow of 435 mgd. Per the Long-Term Control Plan Update and COA, the Water Department expanded the wet weather capacity of this facility. The construction of a 215 mgd High Flow Management System was completed in July 2018, which, when combined with other projects, will allow the Northeast WPCP to provide primary treatment and disinfection of the peak wet weather flow.

The Water Department notes that the Northeast WPCP treated approximately 183 mgd average daily flow and an instantaneous peak flow of 424 mgd in FY 2021. A review of data provided by the Water Department indicates that monthly effluent concentrations for suspended solids and $CBOD_5$ are generally well below NPDES permit effluent limits.

5.4.1 Biogas Cogeneration Facility

BAL Green Biogas I, LLC owns a 5.7 MW Biogas Cogeneration Facility located on land owned by the City of Philadelphia at the Northeast WPCP. The Philadelphia Municipal Authority (PMA) entered into a lease agreement with BAL Green Biogas I, LLC on December 23, 2011. Pursuant to an Intergovernmental Participation Agreement and Facility Sublease, the City, through the Water Department, assumed all the PMA's obligations under the Lease and agreed that during the Lease term, the City would include its obligations under the Facility Lease as operating expenses under the Water Department annual budget for each year.

The Water Department operates the combined heat and power (CHP) Facility to generate energy from biogas produced by the anaerobic digesters located at Northeast WPCP. Four engines produce electricity for use at Northeast WPCP and heat recovered by a propylene glycol solution system used to warm the digesters. Natural gas is blended with the biogas as a supplemental fuel source. Ameresco is contracted for providing Facility maintenance and engine overhauls as defined by a maintenance agreement. The following table provides a summary of the Facility annual expenses. Costs include the lease payments to BAL Green Biogas I, LLC plus maintenance costs paid to Ameresco. In addition, the other expenses include the cost of Water Department operators, administrative and insurance fees, and the cost of natural gas used as supplemental fuel.

Table 5-3. Biogas Cogeneration Facility Annual Expenses

Line No.	Description	FY 2018	FY 2019	FY 2020	FY 2021
1	Lease Payments	$3,632,951	$3,632,951	$3,632,951	$3,632,951
2	Maintenance	$2,292,408	$3,652,901	$1,915,864	$2,240,810
3	Other	$593,394	$694,313	$733,241	$563,844
4	**Total Expenses**	**$6,518,753**	**$7,980,165**	**$6,282,056**	**$6,437,605**

Source: Cogen Cost Data provided by the Water Department

The energy generated by the CHP Facility using the biogas from the anaerobic digesters as the primary fuel source reduces CO_2 emissions by displacing the power purchased from the fossil fuel-based electricity grid and the purchase of natural gas. Based on the historic engine runtime and production rates, the Facility offsets approximately 19,000 metric tons of CO_2 annually.

The lease agreement and maintenance agreement are set to expire on September 25, 2029. The lease agreement does contain options for purchasing or returning the Facility. The Early Buyout Option date is September 25, 2023 (FY 2024) with a set purchase price of $27,150,000. There is also the option to purchase the Facility at the end of the lease at a fair market value price. The Water Department is currently in the process of evaluating its options for the Facility, including the financial and sustainability impacts of the Facility. Section 2.0 of this Report does not include the impact of purchasing the Facility at the early buyout date; however, if this occurs, Arcadis assumes that it would be paid from self-generated capital funds and recovered over time from revenue generated from future rates and charges.

5.4.2 Site Visit

Arcadis visited the Northeast WPCP on October 22, 2021. The general process configuration for the treatment plant consists of screening, influent pumping and grit removal, primary clarification, aeration, final clarification and disinfection. The sludge generated is further treated using dissolved air flotation units, and anaerobic digestion for the combined primary and thickened waste activated sludge. Digested sludge is discharged to barges which transport the sludge to the BRC for final processing. The Northeast WPCP receives water treatment residuals from the Baxter Water Treatment Plant.

The facility is staffed 24 hours per day and 7 days per week with an authorized staffing level of 132, and currently 21 vacancies. There are five certified operators. Most unit processes are computer automated and monitored to capture various process trends. This includes the raw influent pumps, bar screen rakes and conveyors, influent flow splitting to the primary settling tanks, scum gates, dissolved oxygen and air flow controls for the aeration tanks, return sludge system components, hypochlorite disinfection, digester feeding, and dissolved air flotation (DAF) thickening system and Gravity Thickener Facility. Automation of final settling tank scum collection is currently under design (71114 PST Set 1 Valve/gate Actuators replacement). Dedicated operator stations have computer monitors which are used to assist the operator in making process control decisions. Process and lab data are available via web-based reporting which has improved the analysis and trending of data collected.

The on-site process control laboratory is used to check and optimize plant operation, laboratory staff are not included in the plant staff numbers listed above. Analyses required by the plant's NPDES permit are conducted at the Bureau of Laboratory Services Central Laboratory or are sent to a certified contract lab.

5.4.3 Major Projects in Construction, Design or Projects Control

Arcadis reviewed with the Water Department the major projects that are either recently completed or currently underway at the Northeast WPCP (Work No. included in parenthesis for contracted projects):

<u>Major Projects Substantially Completed or in Construction:</u>

- Replacement of aeration tank diffusers (being completed in-house) – ongoing as staff is available

- (71086, 71087, 71105, 71106) New Gravity Sludge Thickeners, is substantially complete. Minor punchlist items remain with completion anticipated in FY 2022.
- (71104) Installation of a new plant entrance gate, nearing completion (programming for card readers)
- (71110) Rehabilitation of Pier 217 North, substantially complete
- (71111) Gas storage tank bladder replacement, completed in FY 2020(71112, 71118) Final Sedimentation Tank Set 2 Pumping and Piping anticipated completion FY 2022
- (71123) Digester cleaning and Dewatering – continuation of an existing contract

Major Projects in the Projects Control/Bidding Process:

- (71085) Replacement of emergency lighting throughout the plant, in Projects Control (FY 2023)(71088) Acquisition of properties for siting of new Pretreatment Building 2023
- (71113) Replacement of boilers and chillers
- (71116) Replacement of sludge gas piping FY 2021 – awarded – in submittals phase
- (71127) Boiler Replacement (PTB & STB)

Major Projects in Design:

- (71096) Replacement of interior and exterior doors throughout the plant being performed with in-house resources (design is approximately 75% complete)
- (71097) Replacement of DAF Mechanisms; Flights and Chains – 60% Design Level
- (71102, 71107, 71108, 71109, 71088) New Preliminary Treatment Facility; Design is complete, this project includes a land acquisition element.
- (71114) PST Set 1 Valve/ Gate Actuators Replacement
- (71119) NE Laboratory Renovation
- (71120) Update of Control Systems (PLCs) – 30% Design level
- (71124) Polymer dosing system – transmitted to Design
- (71125) Fuel oil tank replacement:
- (71128/9) – Aeration system mechanical and electrical instrumentation replacement
- (71130) – Addition of New PTB Area Stormwater Drains
- (71131) – Effluent Pumping Station Addition and Effluent Conduit Betterment
- (71132) – PTB Pump Volute Replacement
- (71138) – Betterment of switchgear for digesters

5.5 Southeast WPCP

As seen in Figure 5-1 the Southeast WPCP serves the east central part of the City, including portions of Center City, South Philadelphia, the Philadelphia Naval Base, and a small portion of Springfield Township in Montgomery County. The Southeast WPCP is designed to handle an average daily flow of 112 mgd and a peak flow of 224 mgd. As per the COA, the 2013 Facility Concept Plan and the 2016 Wet Weather Facility Plan, the Water Department plans to increase peak flow capacity to 274 mgd in 2031. This will be accomplished through process and hydraulic improvements.

The Water Department notes that the Southeast WPCP treated approximately 81 mgd average daily flow and an instantaneous peak flow of 307 mgd in FY 2021. A review of data provided by the Water Department indicates that monthly effluent concentrations for suspended solids and $CBOD_5$ are generally well below NPDES permit effluent limits.

5.5.1 Site Visit

Arcadis visited the Southeast WPCP on October 25, 2021. The general process configuration for the treatment plant consists of bar racks, influent pumping, bar screens, grit removal, flocculation, primary clarification, aeration, final clarification, disinfection with 20% sodium hypochlorite, and effluent pumping. The Water Department trucks screenings, scum, and grit removed from the process to the Southwest WPCP for processing and ultimate disposal to a landfill.

In addition, the Southeast WPCP receives residuals (ferric chloride) discharged from the Queen Lane Water Treatment Plant. These residuals reduce the amount of phosphorus available for the activated sludge process which requires the addition of phosphoric acid to maintain proper nutrient levels. The primary and waste activated sludge have separate sludge transfer pumping systems and two eight-inch force mains convey the sludge to the Southwest WPCP for processing including digestion. The digested sludge is then transferred to the BRC and pelletized for beneficial reuse. Scum and grease collected from the primary and secondary clarifiers is concentrated and then trucked to the Southwest WPCP for separate processing and disposal.

The facility is staffed 24 hours per day and 7 days per week with an authorized staffing level of 68, including three certified operators. There are currently 9 vacancies.

The Process Control Center (PCC) provides automation and control for the plant. The PCC operator has unit process graphic displays available at the Central Computer Console. The Water Department is replacing the original hardware with their current standard. The system can control the influent and effluent pumping stations, primary sludge pumping, final clarifier scum collection, return and waste activated sludge and disinfection systems.

5.5.2 Major Projects in Construction, Design, or Projects Control

Listed below are the major projects that are either recently completed or currently ongoing at the Southeast WPCP: (Work No. included in parenthesis for contracted projects):

- (72075) Concrete repairs and replacement of flights and chains in the 12 Final Sedimentation Tanks is in construction, currently working in the last tank with completion anticipated in Fall 2021.

- (72072) Replacement of sludge return piping
- (72086) Repaving of roads within plant is under construction – punchlist stage
- (72088) Recoat water tower to be performed in FY 2022
- (72091) Compressor Building Roof Replacement and Equipment Storage Structure Betterment – preconstruction meeting held

Major Projects in Projects Control:

- (72069) Replace sludge force main – bids received
- (72070, 72071) Scum Concentration process modifications and rehabilitation. Anticipated to be bid in FY 2022

Major Projects in the Design/Projects Control/Bidding Process:

- (72092) Primary Sedimentation Tanks Betterment – Sent to Design - FY 2025 anticipated bid
- (72093) Laboratory Replacement – Design initiated and anticipated to be bid in FY 2024
- (72081) Replace/refurbish railings throughout the plant. Currently at 30% design level and anticipated FY 2022 construction
- (72089) Building enclosure for grit handling is at 95% design level currently anticipate FY 2022 bid

5.6 Southwest WPCP

As seen in Figure 5-1, the Southwest WPCP serves the western portions of the City and wholesale service areas located in eastern Delaware and southeastern Montgomery counties.

The Southwest WPCP was designed to handle an average daily flow of 200 mgd and a peak flow of 400 mgd. Per the LTCPU the Water Department has committed to implementing improvements to improve the conveyance and treatment of wastewater during wet weather events. The Water Department is currently undertaking several studies to determine how to effectively increase the Southwest WPCP plant capacity to 540 mgd.

The Water Department notes that the Southwest WPCP treated approximately 185 mgd average daily flow and an instantaneous peak flow of 550 mgd in FY 2021 and 173 mgd average daily flow and an instantaneous peak flow of 506 mgd in FY 2020. Except as noted below, a review of data provided by the Water Department indicates that monthly effluent concentrations for suspended solids and $CBOD_5$ are generally well below NPDES permit effluent limits.

In August 2020 the Southwest WPCP The plant exceeded the monthly $CBOD_{20}$ limit. This occurred due to one of the eight grab samples for the $CBOD_{20}$ being pulled during a wet weather event on August 5, 2020, in which the average daily flow for the plant was 426 mgd and the plant flow peaked at 550 mgd, which was the highest recorded instantaneous peak flow for this facility, which has a design capacity of 200 mgd. Since the daily flow was greater than 300 mgd, this qualified for permit relief for the daily $CBOD_5$ and Suspended solids loading, however, no relief is granted for the daily $CBOD_{20}$ loading which resulted in the monthly exceedance.

5.6.1 Site Visit

Arcadis visited the Southwest WPCP on October 25, 2021. The general process configuration for the treatment plant consists of influent pumping, screening, grit removal, pre-aeration/flocculation, primary clarification, secondary treatment using pure oxygen aeration, secondary clarification, effluent pumping, and disinfection. The Southwest WPCP receives water plant residuals from the Belmont water treatment plant and is the only plant to receive septage from haulers.

The Waste Activated Sludge (WAS) from the Southwest WPCP is combined with the WAS from the Southeast WPCP and is sent to the DAF tanks for thickening. The DAF-thickened WAS is then combined with primary sludge from both the Southwest and Southeast WPCPs and pumped to digesters. After digestion, the sludge is pumped to the BRC for final processing. The gas from the digesters is used to heat approximately 22 buildings at the Southwest WPCP. PBS uses some of the digester gas to offset natural gas consumption for its sludge drying operations at the BRC.

The facility is staffed 24 hours per day and 7 days per week with an authorized staffing level of 127, including four certified operators. There are currently 19 vacancies. Plant operators have assigned responsibility for key plant facilities with dedicated operator stations equipped with computer monitors to assist in making process control decisions. The system monitors all unit processes and currently controls aeration tank oxygen feed, return sludge pumping, activated sludge wasting, secondary scum collection, effluent hypochlorite dosing, effluent pumping station, digester tank feeding, dissolved air flotation thickening and primary sludge pumping. Future unit processes to be automated include the primary scum collection system.

An on-site process control laboratory is used to check operating parameters and in coordination with the Industrial Waste Unit monitor the septage receiving program.

5.6.2 Major Projects in Construction, Design, or Projects Control

Listed below are the major projects that are either recently completed or currently ongoing at the Southwest WPCP: (Work No. included in parenthesis for contracted projects):

<u>Project Substantially Completed</u>

- (73079) Replace Switchgear at Effluent Pump Station

<u>Projects under construction:</u>

- Installation of high efficiency lighting: Internal staff have completed areas where lighting fixtures were reasonably accessible, the process buildings lighting fixtures will be replaced as part of capital project.
- (73061) Scum Building switchgear placement.
- (73066) Rehabilitation of DAF tanks.
- (73076) Replacement of Maintenance Building boilers.
- (73085) Scum System Gen/Mech Betterment – Notice to Proceed has been issued
- (73092) Disinfection system upgrade is proposed for FY 2021 construction.

Major Projects in Projects Control:

- (73063) Inspect, repair and paint Gallery Tunnel
- (73082) New Truck Scale Facility
- (73083) Replacement of underground oxygen piping
- (73084) Automation of screenings conveyance and collection

Major Projects in the Design:

- (73065) Final Sedimentation Tank Betterment at 30% design level.
- (73067) Centrate Side Stream Treatment Pilot Project at 30% in Design level.
- (73078, 73080) Replace switchgear in Influent Pump Station and Access Buildings
- (73081) Additional centrate line for redundancy – Currently on hold.
- (73085) Replacement and automation of Primary Settlement Tank scum gate actuators.
- (73086) Automation of the oxygen generation system.
- (73087) Replacement of Aeration Tank mixers.
- (73089) Replacement of process air piping and blowers.
- (73095) Oxygen Plant Cold Box Distillation Betterment
- (73096) Additional Primary Sedimentation Tank.
- (73097) Replace Digested Sludge Underground Piping.
- (73109) Final Sedimentation Tank Return Sludge Betterment
- (73111) Replacement of Southwest Plant Water System
- (73112) Replacement of Southwest Sludge Feed System

5.6.3 Biosolids Recycling Center

Arcadis visited the Biosolids Recycling Center (BRC) on October 25, 2021 and toured the facilities with a site representative from PBS and the Water Department's onsite engineer that monitors performance and compliance with the biosolids service contract. The Water Department sends biosolids from its three WPCPs to the BRC which is located adjacent to the Southwest WPCP. The BRC is capable of producing Class A biosolids which can be used as a soil amendment.

The BRC is operated by PBS under a 20-year service contract that ends on October 13, 2028 and contains the potential for a five-year renewal term at the City's option. PBS designed and built the thermal drying facility onsite and has been producing Class A biosolids pellets since 2012. The Water Department's operating expenses include annual payments to PBS for its operation of the BRC. The FY 2021 proposed amount was $26,660,000, and actual expenditures were $26,065,998. The FY 2022 proposed amount is $26,819,000. The Water Department indicates that the biosolids services contract with PBS has been a success with helping to effectively manage and reuse its wastewater biosolids.

5.7 Wastewater Collection and Pumping

As noted above, the Water Department operates and maintains a significant number of collection system and pumping assets. This includes sanitary, stormwater, and combined sanitary/stormwater sewers that collect and convey wastewater from City residents and wholesale customers. The Water Department manages these assets through its Collector Systems Unit, which includes the following operational units that are described in more detail below and reflected in Figure 5-2. The following sections provide a brief overview of these units, as well as key performance metrics that the units use to track their ongoing progress.

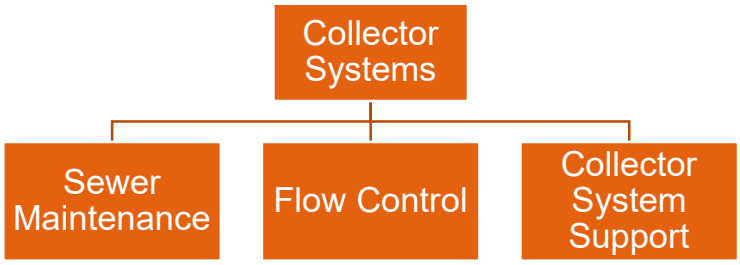

Figure 5-2. Collector Systems Organization

5.7.1 Sewer Maintenance Unit

This unit has several focus areas for which there are dedicated groups or teams, including sewer maintenance; waterways restoration; defective connection; and inlet cleaning. These teams are focused on maintaining the integrity of collection and conveyance systems for both sanitary and stormwater flows. The following provides a brief description of the Sewer Maintenance Unit groups and associated O&M metrics that are used to track their performance on an annual basis.

Sewer Maintenance – This team leads the inspection and maintenance of sewer mains, inlets and manholes for the wastewater system. The teams perform inspections on an ongoing basis, and also pre-inspects segments prior to repairs. Pipe inspections by this team are performed as man-entry inspections. Inspections requiring the use of a crawler camera are referred to the Flow Control Unit. This team also performs inlet maintenance (resets and repairs), excavation for repair of sewers and inlet pipes, dye testing, sewer cleaning, and green stormwater infrastructure maintenance. The authorized staff level for the unit is 219 (excluding Inlet Cleaning as discussed below). As of September 21, 2021, there are 39 vacancies. Table 5-4 provides a summary of work orders used by the Water Department to track Sewer Maintenance activity.

Table 5-4. Sewer Maintenance Unit Work Order History

Category	FY 2018	FY 2019	FY 2020	FY 2021
Sewers Laterals Examined	4,092	5,107	3,879	3,566
Inlets Reset and Reconstructed	7,371	6,046	5,210	5,239
Sewer Excavations/Repairs	238	243	205	157

Waterways Restoration – This team focuses on the inspection of, and debris removal from, local streams and waterways to ensure proper operation and conveyance of stormwater. A key maintenance focus of this team is the removal of bulk debris from local waterways. Table 5-5 presents the amount of debris removal as reported by the Water Department for FY 2018 through FY 2021. In FY 2021, debris removal was lower than typical due to the group's involvement in a restoration project that lasted approximately one month, as well as six staffing vacancies and Pandemic quarantine requirements.

Table 5-5. Waterways Restoration Team O&M Metrics

Category	FY 2018	FY 2019	FY 2020	FY 2021
Tons of debris removed	1,582	1,070	618	613

Defective Connection Group – This group focuses on finding and disconnecting instances of illicit connections to the stormwater system. Illicit connections result in the unwanted discharge of sanitary waste to the separate storm sewer system. When illicit discharges are found, this group works with the Plumbing Repair Unit to correct connections when outside the home. This involves the use of dye testing to narrow the search area. When the origin of the illicit discharge is discovered, the Plumbing Repair Unit is responsible for enforcing and correcting the illicit connection. Table 5-6 presents the number of illicit connections found for FY 2018 through FY 2021. The Water Department estimates that approximately 228.2 million gallons per year of illicit volumes have been prevented from discharging into local streams and waterways by this group.

Table 5-6. Defective Connections Group O&M Metrics

Category	FY 2018	FY 2019	FY 2020	FY 2021
Illicit Connections Found	136	120	73	33

Inlet Cleaning – This group is responsible for the inspection and maintenance of the Water Department's stormwater inlets, including removal of debris from inlets and the relieving of choked inlets. An additional area of focus for this group is on maintenance of green stormwater infrastructure. The unit is responsible for the pretreatment (filter bag) maintenance for all 1,130 street inlets serving green stormwater infrastructure. Currently the unit is authorized a staff of 116 and as of September 16, 2021 had 24 vacancies. The unit currently has eight dedicated staff to green stormwater infrastructure but anticipates that this will increase over the coming years as more green stormwater infrastructure is constructed. Table 5-7 provides an overview of the O&M activities for this group. The reported Inlets Cleaned includes both traditional inlets and green infrastructure pretreatment. The Water Department indicates that approximately 90 percent of this group's work is proactive instead of reactive.

Table 5-7. Inlet Cleaning O&M Metrics

Fiscal Year	Inlets Cleaned	Response Time to Service Requests (Days)
2019	111,979	1.3
2020	93,453	1.4
2021	106,627	1.5

Source: Excerpts from CSO/MS4 annual report to PADEP provided by PWD 10/1/21.

5.7.2 Flow Control Unit

The Flow Control Unit is focused on O&M activities related to the combined sewer overflow system, sewer assessments and GSI inspections, remote wastewater and stormwater pump stations, remote odor control facilities, wastewater metering chambers, and a rain gauge network. Each of these areas is discussed below.

CSO Program – The Flow Control Unit supports the CSO program and minimizing dry-weather overflows through inspections and maintenance of CSO locations and monitoring of flow data.

Sewer Assessments and GSI Inspections – Through a combination of in-house services and contractors, the Flow Control Unit provides CCTV inspections of sewers and GSI. Post-construction inspections are performed in order to determine acceptability of construction and in-service inspections are conducted to facilitate maintenance activities. Pipe inspection data is evaluated to assist in the prioritization of sewer rehabilitation projects. Table 5-8 shows the sewer and GSI inspections performed by the Flow Control Unit over the past four years. The demand for television inspections is expected to increase as the Water Department's capital spending increases. FY 2020 and 2021 results were impacted by reductions in productivity due to the Pandemic. Furthermore, the Flow Control Unit has 18 vacancies out of 97 positions with 5 of 12 positions for sewer inspections currently vacant. The vacancies along with an outside inspection contractor moving out of the area reduced the mileage in 2021. The unit has engaged a new outside contractor and expects them to inspect 20 to 30 miles in the current fiscal year.

Table 5-8. Sewer Inspection Miles

Fiscal Year	2018	2019	2020	2021
Miles of CCTV Sewer Inspections	51.4	43.3	34.2	24.9
GSI Inspections Completed	1,140	1,725	1,033	1,551

Wastewater and Stormwater Pump Stations – The Flow Control Unit is responsible for operation and maintenance of 17 sanitary pump stations and 3 stormwater pump stations. Main pump availability over the past four years is provided in Table 5-9.

Table 5-9. Main Pump Availability

Fiscal Year	2018	2019	2020	2021
% Main Pump Availability	98.9	97.3	98.0	100.0

Remote Odor Control Facilities - The Flow Control Unit provides O&M of two odor control facilities that use sodium hypochlorite solution to eliminate odors.

Wastewater Metering Chambers - Flows from surrounding communities are metered as they enter the Water Department's collection system. The Flow Control Unit maintains the meter chambers and calibrates the flow meters. Operational availability of metering chambers over the past four years is provided in Table 5-10. During the Pandemic, Water Department staff raised concerns about entering the sewer system, which reduced the work performed in late FY 2020. Additionally, crews were also operating at 50% capacity for more than two months.

Table 5-10. Percent Metering Chambers Operational

Fiscal Year	2018	2019	2020	2021
% Metering Chambers Operational	90.6	93.5	92.2	95.7

Rain Gauge Network – The Flow Control Unit maintains a system of rain gauges that are used to support hydraulic modeling efforts and to estimate combined sewer overflow volumes.

5.7.3 Collector System Support Unit

The Collector System Support Unit is divided into three groups (Investigations, Operations and Systems) which support the evaluation and analysis of the collection system. The primary focus of these groups is described below.

- Investigations Group – This group provides analyses of sewer failures to determine root cause, evaluates inspection data to provide input into linear asset capital planning, and supports updating of GIS data for the Water Department's buried infrastructure.
- Operations Group – This group provides analyses of flow meters and level sensors in the collection system to determine maintenance requirements for instrumentation and the collection system. This group also provides input to capital projects for pump stations and flow management structures.
- Systems Group – This group provides support for data acquisition and analysis to assure that systems are correctly configured and functioning. This group also supports analysis of past work practices to inform organizational change.

5.7.4 Capital Projects

Arcadis met with Water Department staff and reviewed ongoing collection system and pumping capital projects. The following provides a brief update of ongoing projects.

- A new maintenance headquarters for Sewer Maintenance's West Philadelphia division is complete and occupied. This facility has received a Leadership in Energy and Environmental Design (LEED) Gold certification and includes a green roof, geothermal heating, and porous pavement.
- Rehabilitation of the Lockart, Bank St., Spring Lane, and Hog Island wastewater pumping stations are currently in Design. Ford Road and Linden Avenue wastewater pumping station rehabilitation are in Projects control. Rennard wastewater pumping station rehabilitation is in construction.
- Rehabilitation of PNBC wastewater pumping station 603 was completed in FY2021 and phase 1 of 2 of force main replacement is underway.
- Belfry Drive wastewater pumping station rehabilitation was completed in FY2021.
- Broad St. & Boulevard and Mingo Creek stormwater pumping stations are in Design.
- A study to evaluate expansion of the 42nd St. Pump Station from 8 to 100 MGD to allow for additional stormwater capture was completed and the project is approved for moving into design. During the storm event that occurred from remnants of Hurricane Ida damage occurred at this facility due to flooding. Flood waters from the Schuylkill River flooded the control room, and the preliminary damage estimate is in the range of $250,000. The proposed capital project is for a betterment of this facility, which includes updating/replacing controls to be above grade at a higher elevation. This project is likely three to four years from construction. This project compliments the GSI program for CSO control and LTCPU compliance.
- The Central Schuylkill Pumping Station is undergoing a rehabilitation project, which includes the replacement of switchgear, pump controls, and installation of all new pumps and motors. Project completion is anticipated in the first half of calendar year 2022.
- New River Road wastewater pumping station is complete.
- New Spring Lane wastewater pumping station is in Design.
- Under a series of large projects, the Water Department is lining 14.5 miles of streamside interceptors consistent with its LTCPU. The overall effort is more than 60% complete.

5.8 Green Stormwater Operations Unit

The Green Stormwater Operations Unit is responsible for the operations and maintenance of GSI. This work is being partly performed via contract services. The Water Department has increased staffing within Green Stormwater Operations, Flow Control, Inlet Cleaning and Sewer Maintenance with the goal of reducing its reliance on contracted services to operate and maintain GSI.

Green Stormwater Operations is performing administrative oversight of maintenance service contracts and developing capacity, policies and procedures to provide these services internally. In addition, this unit manages a group of field staff responsible for grounds maintenance activities associated with the

surface features of GSI. Currently there are 35 positions budgeted in this unit with 11 vacancies. The Water Department plans to add one 4-person grounds maintenance crew annually as the amount of the Water Department's GSI continues to grow. However, evaluations will be ongoing to determine the most economical balance between contracted services and in-house crews.

The amount of GSI assets in operation is expected to grow substantially over the next five years, requiring both increased staffing levels and likely a new maintenance facility for this unit, resulting in annual operating budget increases of 15 to 20%. The Water Department is looking to increase cost efficiencies by changing contracting methods and maintenance protocols. As this unit continues to grow it is looking to establish another maintenance facility to provide better geographic proximity to more of the GSI locations. Because GSI operation and maintenance is a relatively new function for the Water Department, the costs of GSI operation and maintenance will need to be monitored and future budgets may need to be adjusted accordingly based on actual cost performance.

5.9 Toxics Reductions and Control

The Industrial Waste & Backflow Compliance (IWBC) unit's mission is to prevent contamination and reduce pollution. Its primary focus is conducting field-based inspections of primarily private facilities for compliance purposes. The Backflow Compliance group is discussed in Section 4.8.

5.9.1 Industrial Waste

The Industrial Waste Unit is responsible for protecting the City's source water and WPCPs through enforcement of regulations governing wastewater discharges to the Water Department's wastewater collection and stormwater conveyance systems. This unit issues significant industrial user (SIU) permits to regulate industrial discharges to the wastewater collection system. As of June 30, 2021, there were 124 SIUs within the Water Department's service area. SIU facilities are inspected on a calendar year cycle. SIU permit applications require documentation of the raw materials and chemicals used at the facility. The SIU permits require pretreatment based on the type of activities occurring at the facility. This unit issues a periodic newsletter to permittees reminding them of proper disposal methods and documenting award winners for pretreatment compliance.

In addition to administering the industrial waste discharge permit program, this unit also issues permits associated with the discharge of groundwater to the sewer system. Groundwater discharge permits are typically issued for construction projects and remediation projects. As of June 30, 2021, there are 38 active permits. The Water Department requires sampling of groundwater discharged via a groundwater discharge permit for PCBs on a monthly basis. As of June 30, 2021, the majority of the results indicated PCBs levels that were non-detectable by USEPA Method 608. There was one sample in taken in April 2021 that had PCBs detected and resulted in the Department issuing a notice of violation and a fine was issued in Fiscal Year 2022.

Authorized haulers of septage may discharge at the Southwest WPCP after obtaining a hauled wastewater discharge permit. The Industrial Waste Unit oversee the hauled waste program and sampling of hauled waste at the SWWPCP.

The Industrial Waste Unit administers a surcharge program that allows the Water Department to recover the costs from treating wastewater that exceeds the characteristics of normal strength wastewater.

Surcharges are applied for wastewater volumes that exceed 250 mg/L BOD or 350 mg/L TSS. Table 5-11 presents the surcharge revenues for the past four years. Surcharge revenue varies from year to year based on changes in industrial customer wastewater volumes and strengths.

Table 5-11. Surcharge Revenues Collected

Fiscal Year	Surcharge Revenue
2018	$ 5,627,537
2019	$ 4,698,732
2020	$ 4,957,159
2021	$ 5,023,673

The Industrial Waste Unit also receives and processes applications for sewer rental factors (SRF). The SRF is a billing credit for commercial and industrial customers that can demonstrate they have on-site water loss of at least 5 percent or 225,000 cubic feet per year (whichever is less). On-site water loss may be due to evaporative losses or use of water in producing products. The "lost" water results in wastewater discharges that are lower than the amount of water consumed, and results in a credit to the customer.

The Industrial Waste Unit administers PCB PMP to identify PCB sources and reduce instances of their discharge into the wastewater and stormwater collection systems. The unit maintains an online information sheet and survey regarding property use to determine if PCBs could be a potential concern on a given property. The Water Department has reported that significant reductions in WPCP effluent PCB loadings have been seen over the course of implementing the PMP.

Industrial Waste also samples dry weather flows from the Water Department's 433 stormwater outfalls to identify defective laterals or illicit connections and performs sampling for fecal coliform bacteria. This unit also works to identify the source of the illicit connection if sewage or fecal coliform is detected and performs abatements of cross connections.

Industrial Waste has recently been engaged in performing SARA Title 3, Tier 2 chemical inventory reporting inspections, right to know inspections for the Fire Department. These were previously performed by the Fire Department; however, over the past two years this effort has transferred from the fire department to Industrial Waste. Additionally, Industrial Waste performs all Above Ground Tank inspections and coordinates all tank registrations.

5.10 Conclusions

Based upon our site visits, discussions with Water Department personnel, and our experience with other water and wastewater utilities, we find the general condition of these major wastewater facilities to be in good condition, or adequate steps are being taken to return the facilities to good condition. The Water Department is able to provide reliable levels of service and meet regulatory requirements due to its proactive approach to operations and maintenance. The Water Department regularly reviews its capital

improvement needs and prioritizes to maintain compliance. Based on our observations during our site visits and discussions with staff, maintenance of facilities appears adequate to sustain equipment in reliable working order.

The ongoing Pandemic has impacted the Water Department's operations; however, with the exception of the August 2020 storm related NPDES permit violations at the SWWPCP, it has continued to treat wastewater to standards well below its permit limits. The Pandemic has delayed certain maintenance activities for the collection system and implementation of some capital projects. As the Water Department is returning to a full work schedule, and as the Pandemic abates over the coming years, Arcadis anticipates that the Water Department's performance on these initiatives will return to pre-Pandemic levels.

During our interviews, Water Department staff noted that filling vacant positions has become more challenging in recent years. The challenges include finding qualified individuals to fill positions, as well as using the City's overall hiring process, which can be relatively time-consuming to navigate. There has also been turnover of mid to senior level managers as the workforce ages and approaches retirement age, as well as annual increases in the number of paid days lost. Arcadis recommends that the Water Department pay particular attention to staffing issues to ensure that critical management and maintenance activities continue into the future.

The Water Department is in the process of updating its Wastewater Master Plan. It is expected that this will result in additional capital improvements to rehabilitate or upgrade wastewater facilities. This will result in additional capital improvement costs that need to be funded over the coming years. The master planning process is a proactive approach to laying the foundation for effectively keeping the wastewater system in good working condition.

6 CAPITAL IMPROVEMENT PROGRAM

As part of its regular budgeting process, the Water Department provides the City Council with a CIP budget on an annual basis. Currently, the Water Department has drafted a CIP for the FY 2023 through FY 2028 period and provided it to Arcadis for use in this Report. This CIP provides the basis for estimated capital needs of the Water Department in Section 2 of this Report. The following provides an overview of the FY 2023 through FY 2028 CIP.

6.1 FY 2023 – FY 2028 CIP

The Water Department provided Arcadis with the FY 2023 through FY 2028 CIP, as well as a current listing of projects that are in various stages of planning, design, and construction. Arcadis met with Engineering and Construction Division staff to discuss the general components of the CIP. Table 6-1 provides a summarized list of capital project categories and the associated annual budget. After a slowdown in the implementation of the capital program during the early stages of the Pandemic, the Water Department has resumed bidding all categories of projects in the capital program. Due to the delay in bidding capital projects, the Procurement Department is now faced with a backlog of projects to bid so will take several months to catch up with the backlog. As the Procurement Department is gearing up, the actual spend rate on a yearly basis may vary. Elements of the CIP are discussed below in the following sections.

Table 6-1. FY 2023 to FY 2028 CIP ($1,000s)

Line No.	Description	2023	2024	2025	2026	2027	2028
1	Water and WW Plants and Facilities	$255,000	$326,000	$168,000	$455,000	$195,000	$130,000
2	Sewer and CSO System Improvements	$72,860	$78,860	$83,860	$89,860	$94,860	$100,860
3	Water Conveyance System Improvements	$123,060	$120,060	$315,060	$122,060	$130,060	$120,060
4	Flood Relief	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
5	Stream Restoration	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
6	Green Stormwater Infrastructure	$73,000	$73,000	$73,000	$146,000	$146,000	$146,000
7	Vehicles and Equipment	$12,000	$12,000	$12,000	$12,000	$12,000	$12,000
8	Meters	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
9	Engineering and Admin.	$14,321	$14,321	$14,321	$14,321	$14,321	$14,321
10	**Total CIP**	**$580,241**	**$654,241**	**$696,241**	**$869,241**	**$622,241**	**$553,241**

Note: Reflects uninflated CIP.

6.1.1 Water and Wastewater Plants and Facilities

These capital projects focus on improvements and upgrades primarily to water and wastewater treatment plants and pumping facilities. The spending at the plants and facilities reflects planned improvements to the water system as identified in the Drinking Water Master Plan. These improvements reflect upgrades to several pump stations, as well as treatment plant improvements.

Also included in this category are projects related to the wastewater treatment plants, including treatment plant improvements related to the Water Department's compliance with the COA.

6.1.2 Sewer and CSO System Improvements

This category focuses primarily on sanitary, stormwater, and combined sewer system improvements. The Water Department maintains a significant system of collector mains throughout its service area. Many of these mains have been in service and are in need of reconstruction or replacement. Additionally, this category focuses on expanding the capacity of existing mains to enhance the capture of wastewater and stormwater, particularly during wet weather events. Approximately $10 million of the annual budget for this category is dedicated for combined sewer system improvements to reduce the instances of combined sewer overflows in accordance with the COA.

6.1.3 Water Conveyance System Improvements

Water conveyance capital projects are primarily geared toward the replacement of aging water mains. As noted above in Section 4, the Water Department plans to increase the annual water replacement rate from less than 20 miles per year in recent years to 42 miles per year by FY 2024. The potential benefits of increasing the water main replacement rate include reduction in the number of main breaks, resulting in improved system reliability, and the reduction of non-revenue water from system leaks and breaks.

6.1.4 Flood Relief and Stream Restoration

Table 6-1, Lines 4 and 5 reflect the capital budget for Flood Relief and Stream Restoration. Certain sections of the City are relatively more prone to significant flooding during wet weather events. These projects focus on improvements to mitigate or eliminate flooding in these areas. Stream Restoration includes improvements to urban streams that convey stormwater during wet weather events, including preventing erosion and improving their overall water quality of the City and region.

6.1.5 Green Stormwater Infrastructure

The implementation of Green Stormwater Infrastructure will continue to be a significant focus as the Water Department continues to implement the Green City, Clean Waters program in accordance with COA requirements. As noted above in Section 5, the COA includes requirements to steadily increase the number of greened acres installed. This portion of the CIP focuses on greened acres to be designed and constructed by the Water Department, including public rain gardens and other projects to effectively capture stormwater and prevent it from entering the combined sewer or storm sewer systems.

6.1.6 Vehicles and Equipment

This category includes capital expenditures for the replacement of vehicles and heavy equipment required by the Water Department. This includes the replacement of trucks and heavy equipment such as backhoes, dump trucks, vactor trucks, and other similar equipment that is required for water and wastewater utilities to effectively perform their work.

6.1.7 Meters

This category reflects capital expenditures for the Water Department's meters and associated meter read equipment. The annual amounts are for ongoing replacement of meters and equipment.

6.1.8 Engineering and Administration

This category reflects capital budget amounts for Water Department staff involved in the design and construction of the CIP projects noted above in other categories. It includes salaries and wages for staff focused on project design, contractor oversight, construction monitoring, and other work required to complete capital projects.

6.2 Prioritization of Projects

The Water Department has a significant number of capital projects that are constantly in the design, bidding, or construction phases of implementation. Arcadis discussed with the Engineering and Construction General Manager the general process for prioritizing the implementation of capital projects. For water and sewer main replacement projects, information related to the break or failure history, as well as the critical nature of the segment is evaluated. The most critical segments are expedited so that they are bid with priority. Another priority factor is coordination with other third-party projects. This includes completing main replacement projects in coordination with other ongoing, third-party construction activities to limit repeat disruptions.

For treatment plants and other facilities, projects are generally prioritized by operational need, or per regulatory compliance timelines such as the GCCW program.

6.3 Conclusions

The Water Department plans to undertake a significant number of capital improvements in the coming years. The capital projects are focused on all aspects of the System, including continued implementation of the COA and proactive improvements to the water system per the Drinking Water Master Plan. The CIP indicated in this Section reflects budgeted amounts that the Water Department intends to submit to City Council as part of its overall FY 2023 budget request. The CIP appears in line with identified capital needs and is reviewed and updated on an annual basis to reflect changes in conditions and priorities. Section 2 of this Report provides a capital flow of funds estimate by Fiscal Year associated with this CIP, as well as a financial projection that outlines additional bond issuances and revenue increases necessary for completing capital improvements that originate from this budget.

7 REPORT CONCLUSIONS

7.1 Considerations and Assumptions

In preparation of this Report, Arcadis performed our due diligence with respect to visiting major facilities, interviewing key Water Department staff, and reviewing information and documents provided by the Water Department. Arcadis has made a number of principal considerations and assumptions (as provided throughout this Report); some of the most notable are as follows:

1. The Water Department will implement improvements in general accord with the capital improvements plan, including the obtainment of necessary authorizations from the City in a timely manner with respect to budgetary and other legal requirements. The Water Department will make adjustments to its planned schedule for implementation of capital improvements in order to accommodate changes in project budgets that may occur as the projects move from the concept stage, to preliminary design, and ultimately to construction and implementation. It is anticipated that the Water Department will adjust its capital plan as needed to address any unforeseen needs in a reasonable manner.
2. Billed usage under existing rates and charges is assumed to decrease at an annual rate of 1.25 percent based on recent trends. As the Water Department implements the projected revenue increases as outlined in this Report, it is assumed that billed usage will decline further at an annual rate of approximately 2.25 percent for FY 2024 and FY 2025, and then at an annual rate of 2.0 percent for the remainder of the projection period as customers adjust to increased water and sewer bills.
3. The Water Department will issue debt of similar magnitude and timing to the projections in this Report. There are several projects that will ultimately be funded via Pennvest Loans. The Pennvest Loan debt service is estimated using reasonable assumptions for monthly loan draw amounts and project completions dates. Depending on the actual implementation schedule, actual debt service for these projects could be materially different from this Report.
4. The Water Department has initiated a CP Program to assist with funding its CIP. Key assumptions for the CP Program outlined in Section 2.0 include:
    - The Water Department will utilize approximately $170M from FY 2022 to FY 2028 to fund project commitments related to Pennsylvania Infrastructure Investment Authority (Pennvest) projects. As the projects are constructed, the Water Department will pay contractors via regular CP draws and submit reimbursement requests to Pennvest. Upon receipt of Pennvest reimbursements, the Water Department will pay off the drawn CP amounts.
    - Pennvest reimbursement amounts will be repaid over time as long-term, senior debt service.
    - Annual interest related to the drawn CP amounts will accrue and be paid similar to the Water Department's other senior debt service. The CP Program annual interest payments are included in the Rate Covenant debt service coverage calculation for this Report.
5. The Water Department will implement the rate and charge increases and initiatives described in this Report to achieve increases in revenue and to manage expenses as presented in the financial projections.

6. If additional funds are required for the management, operation, and maintenance of the System, the Water Department will either seek the necessary rate and charge increases to increase revenue, or embark upon cost reduction measures, such as reducing nonessential programs. Unforeseen expenses that are not currently anticipated may result from a change of law or regulation, uninsured catastrophic event, previously unidentified capital improvements, unanticipated increases in utilities, chemicals, sludge disposal costs, or other expenses, increased inflation compared to the assumed annual increases in this Report, deferred capital improvements that must be accelerated, or currently undefined or unanticipated additional regulatory enforcement actions.
7. The uncertainty caused by the Pandemic could have unforeseen consequences including impacts to revenue and revenue requirements, changing customer usage patterns, further delays in capital project implementation, impacts to ongoing maintenance activities, and mandated restrictions imposed by governmental bodies. The financial projection in this Report assumes a gradual return to pre-Pandemic performance by FY 2024, including a resumption of residential customer shut-offs for delinquencies, as well as no additional significant stay-at-home orders or other requirements that would significantly impact customer's ability to pay water bills. Arcadis assumes that any uncertainty and resulting unforeseen circumstances will be addressed appropriately by the Water Department to keep the System in good working condition while managing financial operations to achieve at least the results outlined in Section 2.0.
8. Inflationary impacts on operating and capital costs will be generally consistent with the assumed inflation factors outlined in this Report. Should the actual, projected inflation for operating and capital costs differ materially from this Report, Arcadis assumes the Water Department will manage operations, the implementation of the CIP, and its finances in a manner to maintain the System in good working order while achieving at least the financial results outlined in Section 2.0.

This Report was prepared solely for the benefit of and use by the City for the discrete purposes set forth herein. The City did not request Arcadis to provide, and Arcadis does not offer to provide, nor did or will it provide, any services constituting the services of a "municipal advisor" as defined by the Securities Exchange Act of 1934, as amended by the Dodd–Frank Wall Street Reform and Consumer Protection Act (Pub.L. 111-203, H.R. 4173) and regulations promulgated thereunder, or any successor statute or provisions thereto. Accordingly, Arcadis is not a municipal advisor registered with the U.S. Securities and Exchange Commission (SEC).

Arcadis is required to make disclosures stating the limitations of the work contained within this Report and its use. In accordance with the Securities Exchange Act of 1934, the following disclosure statements are incorporated into this Report prepared by Arcadis:

In the performance of its services on behalf of the City, Arcadis is (a) not recommending any action on behalf of the City to municipal financial products or the issuance of municipal securities; (b) is not acting as a municipal advisor to the City, and does not owe a fiduciary duty to the City pursuant to Section 15B of the Securities Exchange Act of 1934, as amended by the Dodd-Frank Wall Street Reform and Consumer Protection Act, with respect to the information and material prepared in connection with this scope of work; and (c) acting for its own interests. The City shall engage a registered municipal advisor and shall discuss any information and material prepared in connection with this Report with any and all internal and external registered municipal advisors and other financial advisors and experts whom the City deems appropriate before acting on this information and material.

The City acknowledges that: (a) it shall retain, and has retained, the services of an independent registered municipal advisor, who, during the past two years, was not associated with Arcadis, and that (b) Arcadis is required to comply with the requirements set forth in the federal Exchange Act, Municipal Advisor Rule (17 CFR 200, 240, 249), which requires that Arcadis (i) receive from the municipal entity a representation in writing that it is represented by, and will rely on the advice of, an independent registered municipal advisor; (ii) provide written disclosure to the municipal entity that Arcadis is not serving as a municipal advisor and, with respect to the municipal entity, is not subject to the statutory fiduciary duty applicable to municipal advisors under the federal Exchange Act, and (iii) provide a copy of such disclosure to the municipal entity's independent registered municipal advisor. Arcadis does not provide opinions on or advocates for using a financial product (issuing debt) or the choice of financial products employed.

In the performance of its services on behalf of the City, Arcadis did not intend to create, and hereby expressly denies the creation of, any right on the part of any third party to rely upon this Report. Except as otherwise provided by statute not subject to waiver, the City is not permitted to distribute copies of this Report to third parties without the prior written consent of Arcadis and, further, any such distribution of this Report is for only informational purposes, and third parties have no right to rely hereon. Use of this Report should not, and does not, absolve the third party from using due diligence in verifying the Report's contents.

Arcadis' effort in the construction and preparation of this Report is consistent with (i) the degree of care and skill ordinarily exercised by members of the same profession currently practicing under same or similar circumstances and (ii) the time and budget available for its work in its endeavor to ensure that the data contained in the Report is accurate as of the date of its preparation. This analysis was based on estimates, assumptions and other information developed by Arcadis from its independent research effort, general knowledge of the industry, and information provided by, and consultations with, the City and its agents, representatives, and consultants. Arcadis assumes no responsibility or liability for inaccuracies in Reporting and data provided by the City and its agents, representatives and consultants, or in any third-party data source used in preparing or presenting this study.

Arcadis did not independently verify the accuracy of the information provided by the City and others in creating this Report; however, Arcadis' opinion is based upon the supposition that such sources are reliable and the information obtained therefrom is appropriate for the analysis undertaken and the conclusions reached. While we believe such sources are reliable, and the information obtained to be accurate and appropriate for the analysis undertaken and the conclusions reached herein, as is often the case, there may be differences between actual and projected results. Accordingly, some of the estimates used in this Report will not be realized, and unanticipated events and circumstances may occur. To the extent the information provided to Arcadis by the City and others is not accurate, or not inclusive of all details, the conclusions and recommendations contained in this Report may vary, and are subject to change. Moreover, there are likely to be differences between the data and results projected in this Report and actual results achieved, and those differences may be material. Accordingly, Arcadis assumes no responsibility for inaccuracies in Reporting by the City or any third-party data source used in preparing such opinion.

Additionally, Arcadis relied on assumptions, forecasts, data and statistics provided by the City and others. Forward-looking statements included in this Report, which may be identified by the use of words like

"anticipate", "believe", "estimate", "expect", "intend", "may", "plan", "project", "will", "should", "seek", and similar expressions, refer to Arcadis' views and assumptions with respect to future events as of the date of this Report, and are subject to future economic conditions, results, and other risks and uncertainties. Actual and future results and trends could differ materially from those set forth in such statements due to various factors, including, without limitation, those mentioned in this Report. These factors are beyond Arcadis' ability to control or predict. Accordingly, Arcadis makes no warranty or representation that any of the projected values or results contained in this Report will actually be achieved.

Arcadis' findings represent its professional judgment. Neither Arcadis, nor its parent corporation, or their respective subsidiaries and affiliates, makes any warranty, expressed or implied, with respect to any information or methods disclosed in this Report. No recipient of the Report shall have any claim against Arcadis, its parent corporation, and/or its and their subsidiaries and affiliates, for any liability for direct, indirect, consequential, or special loss or damage arising out of its receipt and use of this Report whether arising in contract, warranty (express or implied), tort or otherwise, and irrespective of fault, negligence and strict liability.

No recipient of this Report may abstract, excerpt, or summarize this Report without the prior written consent of Arcadis. Any changes made to this Report, or any use of this Report not specifically identified or otherwise expressly approved in writing by Arcadis, shall be at the sole risk of the party making such changes or adopting such use.

This Report is qualified in its entirety by, and should be considered in light of, these limitations, conditions and considerations.

7.2 Conclusions

Set forth below is a summary of the conclusions which Arcadis has reached regarding its review of the Water Department. For a complete understanding of the assumptions upon which these opinions are based, the analyses undertaken, and the risks with regard to the Water Department's financial performance, the Report should be read in its entirety.

1. The Water Department plans to increase capital spending significantly through FY 2028, and regular bond issuances are anticipated to fund a portion of the capital expenditures. This will require consistent revenue increases to the Water Department's service charges to meet revenue requirements, target debt service coverage levels, and reserve fund balances. At the time of this Report, the Water Department has drawn its combined Residual Fund and Rate Stabilization Fund reserve levels below its established target of $150 million. The revenue increases in FY 2024 and FY 2025 are relatively higher than recent historical revenue increases; however, they are necessary to implement the CIP as projected, achieve the targeted senior debt service coverage of 1.30, and return and maintain the combined Rate Stabilization Fund and Residual Fund reserves at or above $150 million over the projection period.
2. The System will yield pledged Project Revenues, including the projected increases in service revenue indicated in the Report, over the amortization periods of the water and wastewater revenue bonds anticipated to be issued in FY 2023 and FY 2024, sufficient to meet the projected payments or deposit requirements of:
    - all projected operation, maintenance, repair and replacement expenses of the System;

- all reserve funds required to be established out of such Project Revenues; and
- the principal or redemption price of and interest on anticipated Bonds, as the same become due and payable, for which the Project Revenues are pledged.

3. The Net Revenues are currently sufficient to comply with the Rate Covenant and are projected to be sufficient, including the projected increases in service revenue indicated in the Report, to comply with the Rate Covenant for each of the two Fiscal Years following the Fiscal Year in which the anticipated FY 2023 and FY 2024 revenue bonds are issued, including the two Fiscal Years (FY 2024 and FY 2025) following the Fiscal Year up to which interest has been capitalized (FY 2023) on the Series 2020A revenue bonds. This includes the requirement to yield Net Revenues that are at least:
   - 1.20 times the Debt Service Requirements for such Fiscal Year (excluding Debt Service Requirements in respect of Subordinated Bonds); and
   - 1.00 times (A) the Debt Service Requirements for such Fiscal Year (including Debt Service Requirements in respect of Subordinated Bonds); (B) amounts required to be deposited into the Debt Reserve Account during such Fiscal Year; (C) the principal or redemption price of and interest on General Obligation Bonds payable during such Fiscal Year; (D) debt service requirements on Interim Debt payable during such Fiscal Year; and (E) the Capital Account Deposit Amount for such Fiscal Year (less any amounts transferred from the Residual Fund to the Capital Account during such Fiscal Year); and
   - 0.90 times Debt Service Requirements for such Fiscal Year (excluding Debt Service Requirements in respect of Subordinated Bonds); provided that, for purposes of this clause Net Revenues shall be calculated to exclude any amounts transferred from the Rate Stabilization Fund to the Revenue Fund.
4. The FY 2023 revenue increase is subject to reduction per the recent rate proceeding during a Special Rate Reconciliation Proceeding to be initiated by the Water Department on or before March 1, 2022. The financial projection in this Report assumes the full revenue increase is maintained for the projection period, which would provide a baseline of additional revenue to support known, future capital and operating costs while maintaining targeted reserve fund balances. Should any significant reduction to the FY 2023 revenue increase result from the Special Rate Reconciliation Proceeding, it is more likely that future, higher revenue increases will be necessary assuming the Water Department's operating and capital expenses remain as projected. The Water Department will need to assess the impact of any reduction to the FY 2023 revenue increase and make appropriate financial adjustments as necessary to achieve the projected results reflected in this Report.
5. The Water Department is currently managing the System amidst the Pandemic. Arcadis has provided a financial projection as part of this Report that includes assumptions with respect to the impact of the Pandemic on collected revenue and financial performance. While we believe these assumptions are reasonable for this Report, it is noted that there is still uncertainty with respect to the Pandemic that could result in negative financial performance, and actual results may differ from the projection in this Report. Should the impact of the Pandemic result in financial performance that is materially lower than projected herein, it is assumed the Water Department will take the necessary actions to reduce operating expenses, delay capital improvements, or increase rates and charges as necessary to meet the General Ordinance Rate Covenant and provide critical operation and maintenance of the System.

6. Based upon Arcadis' site visits consisting of visual observations to each of the treatment facilities in October 2021, discussions with Water Department personnel, and Arcadis' experience with other water and wastewater utilities, Arcadis finds the System to be in good operating condition, or adequate steps are being taken to return it to good operating condition. The Water Department has demonstrated that it is able to provide reliable levels of service due to its proactive approach to operations and maintenance. The Water Department regularly reviews its capital improvement needs and prioritizes capital expenditures to address the most critical issues to maintain compliance and preserve water quality. Maintenance of facilities appears adequate to sustain equipment in reliable working order. The proposed six-year capital program for FY 2023 through FY 2028 appears in line with identified capital needs.
7. The Water Department has an organizational structure that facilitates accomplishing its mission of reliably delivering high quality water; treating wastewater to high standards; and effectively managing stormwater for its customers. Water Department divisions are appropriately focused on the operational, planning, engineering, and administrative functions that are common to effective water and wastewater utilities. The overall organizational structure is generally consistent with other water and wastewater utilities providing similar services. Divisions are currently led by experienced managers capable of leading staff to provide effective system operations, maintenance, and administrative management to maintain adequate and reliable service levels.
8. The Pandemic has created additional administrative hurdles to the Water Department, including transition to work from home, modifications to office and workspaces, and enhanced safety precautions. These hurdles require additional effort and time from management and staff compared to the normal course of business; however, the Water Department continues to adapt to the Pandemic conditions to perform its mission. With the exception of the August 2020 storm related NPDES permit violations at the SWWPCP, the Water Department has continued to consistently meet its regulatory requirements. The Pandemic has delayed several initiatives, including the implementation of requirements related to the COA, work and maintenance activities for the collection system, and implementation of some capital projects. The Water Department has returned to a full work schedule and as the Pandemic continues to abate, Arcadis anticipates that the Water Department's performance on these initiatives will return to pre-Pandemic levels.
9. During our interviews, Water Department staff noted that filling vacant positions has become more challenging in recent years. The challenges include finding qualified individuals to fill positions, as well as using the City's overall hiring process, which can be relatively time-consuming to navigate. There has also been turnover of mid to senior level managers as the workforce ages and approaches retirement age, as well as annual increases in the number of paid days lost. The shortage of qualified staff may potentially be exacerbated as vaccine mandates by the City may result in termination of certain Water Department staff that do not comply with the City's mandate. There are also several areas where the Water Department has recently not been able to achieve its targeted level of proactive maintenance. If staffing issues are prolonged, this could eventually lead to decreased service life of equipment and additional capital or maintenance costs. Arcadis recommends that the Water Department pay particular attention to staffing issues to ensure that critical management and maintenance activities continue into the future.

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