

Assessment of PWSA's Capital Investment Programming and Planning

Presented October 8, 2014



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1.0 INTRODUCTION

In support of Infrastructure Management Group, Inc. (IMG) and the City of Pittsburgh Restructuring Advisory Team, Tetra Tech completed a high-level review of the Pittsburgh Water and Sewer Authority (PWSA or Authority) capital improvement programming (CIP) and planning protocols. Special consideration was given to the Authority's capital planning process and practices for identifying and prioritizing capital projects.

Tetra Tech relied on information obtained from interview(s) with PWSA's capital program managers, *2017-2021 Capital Improvement Program* supplemented by an updated summary of capital projects provided on October 4, 2017, and the *40-Year Capital Plan and Water and Sewer Master Plan* prepared by Chester Engineers (2012). The information was used to understand and qualitatively measure the degree to which PWSA has:

1. Developed and implemented a process of how decisions are and will be made in the capital planning process including a structured process for prioritizing projects and allocating resources;
2. Inventoried its assets, including location, life-cycle and condition;
3. Identified capital needs.

2.0 CURRENT STATE

The Authority is responsible for carrying out a Capital Improvement Program to restore and repair their water, sewer, and storm system assets. A *40-year Capital Plan and Water and Sewer Master Plan* (Chester Engineers 2012) was prepared for PWSA to identify repair-and-replacement projects and estimate the financial resources needed for the recommended capital improvements. The 2012 Plan presented the system inventory and condition, asset valuation, system deficits, and capital need recommendations based on information from staff and a desktop review of inventory statistics, GIS data, PWSA water distribution system model, cost reference handbooks, CapPlan program analytics, and previous reports.

While the overall methodology contained the key components for identifying capital needs, feedback from PWSA indicates that the 2012 Plan lacked the external field validation of the actual asset condition to appropriately prioritize, schedule, and prepare costs for the capital projects, as demonstrated in the following examples:

- **Aspinwall Pump Station:** The 2012 Plan's capital improvement cost and schedule for the Aspinwall Pump Station was \$4.2 million based on replacement intervals for the roof and pumps/motor control centers over a 40-year period. A 2017 design and condition assessment of the same pump station resulted in asset improvement costs five times more than the 2012 Plan over the next 15 years. The 2017 condition assessment identified multiple deficiencies that required more immediate attention than the roof and pumps, including the more severe conditions where the *"main HVAC system falls short of operational guidelines and suffers from several operation deficiencies"* and *"the main electrical infrastructure throughout the pump station exceed its useful life and is quickly approaching the point of potential catastrophic failure. System functional redundancies have been substantially reduced due to the age of the equipment available parts."*

- **Water Main Replacement Program:** The 2012 Plan acknowledged that a more aggressive water main replacement program was needed to address the risks of failure with the aging pipes. The 2012 Plan analysis was complicated as it relied on the limited digital information that accounted for less than 10 percent of each pipe size and then filling in data gaps with office records and calculation books; no field assessments were conducted to verify locations or the conditions. The CapPlan program was used to calculate the risk-of-failure for pipe segments based on the age and available maintenance records. The CapPlan program was also used to develop a budget for replacing or rehabilitating pipe segments with medium to high risk of failure. The 2012 Plan estimated a \$14.8 million cost per year over the next 40 years for the water pipe replacement program. PWSA reported, however, that the costs did not capture 1) the complexity of an urban setting and the challenging utility conflicts encountered within the right-of-way due to lack of enforcement and 2) the severity of observed pipe wall corrosion that resulted from historic use of slag backfill during installation. PWSA's financial planning sheet estimates that the projected water main replacement costs over the next 15 years is in the order of \$50 to \$60 million a year.

The above examples reflect the significance of field-verified condition assessments to substantiate the useful life, current condition, and location of the Authority's assets. PWSA has reported that years of deferred or lack of maintenance and inadequate asset management practices have led to the deterioration and malfunction of assets both before and beyond the estimated life. The Authority has many assets that are now in critical need of immediate repair or replacement to provide continuous and reliable water supply.

PWSA is also required to focus on addressing mandated projects that are subject to fines and are under administrative consent order (ACO) and consent order and agreements (COA). The Authority specifically has capital projects in place to address the 1) the ACO issued by the Allegheny County Health Department (ACHD) for separate system communities, 2) the COA issued by the Pennsylvania Department of Environmental Protection for combined sewer overflow (CSO) communities, and 3) the joint Consent Decree entered by ALCOSAN with the U.S. Department of Justice and U.S. Department Environmental Agency, PaDEP, and ACHD for Wet Weather Planning to control sanitary sewer overflows (SSO) and CSOs in the Authority's service area. Water quality related projects that are also under mandate include membrane filtration plant improvements, disconnecting and repairing over 300 washout locations, and lead service line replacement. In addition, PWSA has been faced with having to respond to incidental repair projects for vital assets, such as the repair of the water main support defects and air release valve that were reported during a Pennsylvania Department of Transportation inspection of the Fort Duquesne Bridge.

PWSA is currently faced with the difficult task of (1) establishing a baseline understanding of their assets, the asset conditions and replacement costs (2) prioritizing critical capital projects to address the significant system-wide deficiencies, and (3) fully implementing a capital program within a 5-, 10-, and 15-year timeline.

3.0 PWSA CAPITAL PLANNING VISION AND ROLL OUT

Historically, PWSA has not had a formal CIP. In 2014, PWSA introduced the CIP program to assist in developing a capital planning process that would help the Authority produce a plan that reflects actual conditions, prioritizes capital projects, and shift the "fix-as-fail" paradigm to a more proactive approach. Through discussions with PWSA's program management team, the overall accomplishments that they are hoping to achieve through the CIP development process are to:

1. Implement a capital improvement program that develops 5-year plans that are in line with national standards.
2. Develop financial support programs and revitalize the operating budgets.
3. Secure and maintain staff with appropriate skills that are committed to carrying out the program.
4. Have a Board that recognizes and supports the capital and financial needs of the Authority.

PWSA's CIP process is as follows:

- **Capital Project Identification and Prioritization:** Standard industry practice for project identification and prioritization relies upon a condition/criticality algorithm to rank assets based on the probability of failure, consequence of failure, and redundancy. Those assets with a high risk of failure and poor condition are prioritized over those assets with a lower ranking. However, due to a lack of a comprehensive condition assessment, the projects in the PWSA CIP are generally prioritized based on risk of failure addressing the following categories: safety, regulatory compliance, reliability operational flexibility, capacity, operations and maintenance efficiency, regional cooperation, level of service, and sustainability. Prioritization can change as on-going operations and condition assessments reveal additional criticalities.
- **Project Cost Estimation and Scheduling:** PWSA's process for developing cost estimates for the identified CIP projects follow the general guidelines for planning level cost estimates. The estimates are based upon local data from similar projects as well as cost data from industry sources. Project estimates also include design, project management and construction services. For projects that span multiple years the cost estimates are segmented into major project phase (design and construction) and scheduled based on an anticipated completion time in line with industry practices.
- **Development and Approval Process:** The cycle generally begins in January when project nominations are solicited from the entire organization. At the completion of the nomination period, the Planning Department screens and evaluates the nominated projects using a risk-based prioritization methodology (**Attachment 1**), and recommends which projects should be considered for further planning. Further planning efforts consist of the preparation of a Project Sheet, which provides more detailed information on a project's potential scope option, risks, schedule, and the development of a preliminary cost estimate. This process lasts several months and culminates with the presentation of an updated CIP to PWSA's Board of Directors for approval in October/November. Projects that are not selected for execution are reassessed during the following year's CIP development process. **Attachment 2** provides an overview of the desired project approval flow, however, PWSA has indicated that the approval process is often short-circuited due to the expedited nature of responding to urgent repairs.

According to PWSA, a CIP was presented in 2015 to the Board, who informally indicated that the work should begin. However, the interim executive director at that time and the Board were not prepared to raise the rates to allow the program to begin. In 2016, the Board formally received the proposed CIP, but, consistent with previous practice, never formally endorsed it. Detailed facility assessments needed to prioritize capital work were to be initially funded with 2016 operating budgets, however, the budget could not support the \$1.7 million needed for the assessments.

Instead, capital projects related to green stormwater infrastructure and lead service line activities were funded to comply with Consent Orders. Remaining capital work in 2016 were small \$1 million contracts for hydrant replacements and pump repair type projects. The following year, the Board’s Capital Plan review and project budget resolution was able to restore key projects and the Board accepted the CIP and authorized 7 of the 66 projects presented in the 2017-2021 CIP to begin. These projects were identified as the highest risk projects based on safety, regulatory compliance, and reliability/operational flexibility. PWSA has continued to bring other project resolutions to the Board for their approval at subsequent Board meetings. These projects, according to PWSA, are being implemented, more or less, in general accordance with the schedule proposed in the 2017-2021 CIP. PWSA’s finance team developed a 2018-2022 financial plan to support the CIP as proposed.

Due to the overall number of projects demanded by the system’s conditions, PWSA has been focusing on trying to roll out large capital projects that would reduce the risk of whole or partial system failure, such as the Clearwell, redundancy in the Lanpher rising main, and Highland Reservoir and Membrane Filtration Plant, and then slowly implement the CIP process. PWSA has started to include inventory and condition assessments as part of the planning and design phase. The Authority has started a distribution hydraulic model and hopes to be able to start evaluating the system in 2018. PWSA is investigating asset management software to aid in analytics. However, as noted through reports prepared as part of this project and as reported by PWSA, the assets are in much disrepair and the source and location for some of the problems, such as source of lead, are not known that PWSA will need to continue to respond to daily malfunctions, failures, and crisis until a better handle of the assets are achieved. PWSA is also anticipating that additional feedback from a recent PaDEP inspection of the water treatment plant in September 2017 will impact the CIP priorities.

4.0 SUMMARY OF PWSA CAPITAL NEEDS

A list of current capital needs as provided by PWSA on October 4, 2017 includes 100 projects with funding requirements totaling \$2.82 billion through 2030. According to PWSA the highly critical projects have been captured in the first 10 years of the CIP. **Table 1** summarizes the number of PWSA capital projects by project class (water, wastewater, storm) and **Figure 2** illustrates the total distributed funding needs through 2030. **Attachment 3** presents the roll-up cost summary of the projected funding distributions provided by PWSA for project types under the water, wastewater, stormwater, and distributed allocation classes.

TABLE 1: NUMBER OF PROJECTS BY PROJECT CLASS

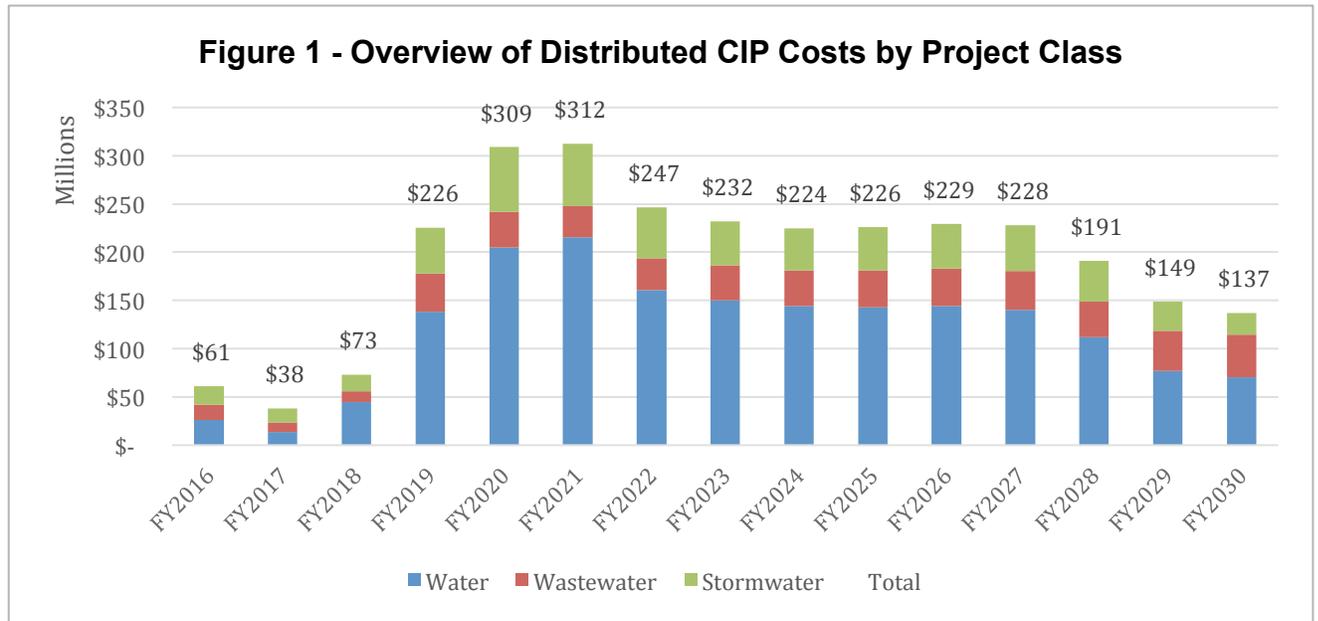
| Project Class | Number of Capital Projects |
|------------------------------------------------------------------------|----------------------------|
| Water | 46 |
| Wastewater | 14 |
| Stormwater | 25 |
| Projects with Distributed Allocations for Water, Storm, and Wastewater | 15 |
| TOTAL NUMBER OF PROJECTS | 100 |

The projects represent the highly critical projects known to date. In addition several “placeholder” projects, such as the water treatment plant or pump stations that are included for other critical projects that are suspected but not yet determined.

Beyond 2030 significant investment will be necessary to further renew and replace the less critical assets in the system. Although the highly critical system needs may be addressed, it is quite likely that once industry standard asset management practices are fully implemented a continuing aggressive renewal and replacement program will be required to update aging infrastructure. In lieu of a long-term planning and based upon the information review, an annual number of \$100 million should be considered (Table 2).

TABLE 2: SUMMARY OF CAPITAL NEEDS

| Planning Period | Estimated Capital Needs (millions) |
|------------------------------------|------------------------------------|
| 2017 to 2021 | \$957 |
| 2022 to 2026 | \$1,158 |
| 2027 to 2030 | \$705 |
| Estimated annual needs beyond 2030 | \$100 annually |



5.0 KEY OBSERVATIONS OF PWSA'S CAPITAL PLANNING PROGRAM

While the intent of the Authority's capital planning process includes best practices for managing a capital planning program, inadequacies along the capital planning cycle are currently constraining full implementation of their program:

- **Inadequate Asset Inventory and Condition Assessment:** An effective asset management plan requires a high level of confidence in the asset inventory and conditions to develop a risk profile and strategy for identifying and prioritizing capital projects. At this time, the Authority is constrained in this effort due to raw data they must rely on to track inventory when no information is available, lack of staff resources to complete condition assessments, and current critical demands of the system. The current capital needs are based on addressing the current known problems and can change annually as additional problems occur. However, without a strong inventory and data collection system in place, it is challenging for the Authority to gauge the full extent of the system's capital needs.
- **Inadequate Prioritization and Capital Budgeting:** Stemming from a general lack of knowledge about the condition of the system's assets, PWSA has prioritized its projects based on a known or perceived criticality of asset failure. With the pervasive poor condition of the system this is a reasonable "stop-gap" methodology, however, it is ultimately incomplete and inefficient and lacks any long-term implementation strategy. Priority projects are nominated annually for implementation however, due to budget constraints, unforeseen system failures and other factors many projects get pushed back. This undercuts the reliability of the CIP and limits its usefulness in long term implementation and funding.
- **Funding:** The proposed capital improvement projects from 2017 to 2030 show a sharp increase in budget needs, which has historically been reported at \$10 million a year, to \$73 million in 2018, and upwards into \$300 million by 2020. PWSA reported that their finance team has developed a 2018 to 2021 financial plan to support implementation of the proposed CIP. However, without approval of the financial plan, lack of budget will likely constrain the ambitious capital program.
- **Project Management Staff and Resources:** PWSA has expressed that, at this time, lack of staff with appropriate skills is one of the biggest constraints for supporting the capital program. The existing bylaws and compensation structure in the City of Pittsburgh has made it challenging to attract the right people to support the capital planning efforts. PWSA has had to rely on contracted professionals to manage and execute the program. However, the Authority's ultimate goal is to secure staff that can oversee and carry out the program.
- **Organization:** A systematic capital planning process would generally involve collaboration among the organization to identify project, survey inventory, and establish scope of the project. However, the team has indicated that this process has been constrained by the critical nature of the projects that the process has been short circuited to move critical projects along.

In general, the Authority is committed to delivering and executing a capital planning program that meets the operational and financial needs of the Authority. However, the Authority must overcome existing constraints to keep the program moving forward.

