PWSA St. No. C-1

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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

DIRECT TESTIMONY OF

ROBERT A. WEIMAR

ON BEHALF OF
THE PITTSBURGH WATER
AND SEWER AUTHORITY

Docket Nos. M-2018-2640802 and M-2018-2640803

Pittsburgh Water and Sewer Authority
Compliance Filing Proceeding

Background of PWSA
Infrastructure and Operations
Lead Remediation
Testimony in Support of LTIIP

February 14, 2019

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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND CURRENT POSITION WITH PWSA.

A. My name is Robert "Bob" A. Weimar. My position with The Pittsburgh Water & Sewer Authority ("PWSA" or "Authority") is Executive Director.

Q. HOW LONG HAVE YOU HELD THIS POSITION?

A. I was appointed Interim Executive Director in April 2017. Prior to that appointment, I worked for PWSA as a capital program manager and interim director of construction and engineering.

Q. WHAT ARE YOUR VARIOUS JOB RESPONSIBILITIES?

A. In my present position, my responsibilities include executing policy goals and objectives established by the Board of Directors; Preparing an annual business plan and budget; Developing, supervising and administering the PWSA's staff and programs; directing the operation of the water system; overseeing the operation of the sewer system and stormwater system; developing and implementing a capital improvement and maintenance plan; directing water marketing efforts; and interacting with customers, elected officials, consumer groups, governmental entities and the media.

Q. PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.

A. I worked in the water and wastewater industries as a professional engineer for 46 years. I have a degree in civil engineering from the University of Massachusetts and completed master's-degree-level classes in water resources at Northeastern University. A more complete description of my background and experience is set forth on Appendix A to this testimony.

Q. HAVE YOU EVER PROVIDED TESTIMONY BEFORE THIS COMMISSION?

A. Yes. I submitted Direct and Rebuttal testimony in PWSA's Initial Tariff and Rate Case (R-2018-3002645, R-2018-3002647).

II. OVERVIEW AND SCOPE OF TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my is to support PWSA's Compliance Plan that was filed on September 28, 2018 and the Compliance Plan Supplement which was filed on February 1, 2019. The topical issues that I will be covering include: (1) background regarding PWSA; (2) infrastructure and operations; (3) lead remediation; and, (4) PWSA's Long-Term Infrastructure Improvement Plan ("LTIIP").

Q. IS PWSA ALSO OFFERING DIRECT TESTIMONY OF OTHER WITNESSES?

A. Yes. The direct testimony from the following PWSA witnesses covering the topics identified below is also being offered in support of PWSA's Compliance Plan and Compliance Plan Supplement:

- Ms. Debbie M. Lestitian (PWSA Statement #C-2) is PWSA's Chief Corporate Counsel and Chief of Administration. She will be providing responses in these areas:[1] (1) accident reporting; (2) completion of physical security, cyber security, emergency response, and business continuity plans; (3) PWSA's Cooperation Agreement with the City of Pittsburgh; (4) Capital Lease Agreement; (5) residency requirement; (6) billing arrangement with the Allegheny County Sanitary Authority ("ALCOSAN"); (7) billing arrangement with Pennsylvania American Water Company ("PAWC"); (8) sales for resales of bulk water; and (9) bulk wastewater conveyance agreements.
- Ms. Jennifer Presutti (PWSA Statement #C-3) is the Budget Director for PWSA. She will be providing responses in these areas:[2] (1) Financing Capital Improvements; (2) Projected Expenditures; (3) System of Accounts; (4) Annual Depreciation Reports; (5) Service Life Study Report; (6) Capital Investment Plan Report; and (7) Other Compliance Plan issues.

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[1] These areas are covered by Directed Questions Nos. 16, 70-81, 91-96, 107-120, as listed on Exhibit RAW/C-1.

[2] These areas are covered by Directed Questions Nos. 2-7, 37-38, 62-69, as listed on Exhibit RAW/C-1.

- Ms. Julie Quigley (PWSA Statement #C-4) is Director of Administration for PWSA. She will be providing responses in these areas:[3] (1) Customer Service Issues; (2) Line Extensions & Special Utility Service; (3) Limitation of Liability; (4) Standby Charge; and (5) PWSA's Customer Assistance Program.

Q. IS THE INFORMATION PROVIDED IN THE COMPLIANCE PLAN, THE COMPLIANCE PLAN SUPPLEMENT AND THIS TESTIMONY INTENDED TO BE STATIC?

A. No, I believe it is important to establish at the outset that PWSA's effort to come into compliance with the Commission's requirements is an evolving process that is interdependent on many factors some of which are completely outside the control of PWSA. For example, PWSA's ability to address meters is dependent in large part on having plumbers available to do the work. If PWSA is unable to either hire or contract with a sufficient number of plumbers, then its target dates are likely to change. Similarly, PWSA is subject to various environmental requirements and regulations and if, for example, the DEP directs PWSA to prioritize a project that it had not planned on doing, and then PWSA would need to reshuffle other priorities to accommodate such request. Something like this would likely change current estimated target dates to complete various tasks. Because of this, the target dates and anticipated project priorities that are set forth in the Compliance Plan, the Compliance Plan Supplement and this direct testimony are all subject to change. To the extent some of these target dates have already begun to shift from what was stated in the Compliance Plan Supplement, I want to be clear that what is presented in the direct testimony being submitted now reflects PWSA's current expectations.

[3] These areas are covered by Directed Questions Nos. 31-33, 44-50, 52-60, as listed on Exhibit RAW/C-1.

Q. PLEASE EXPLAIN HOW THE COMMISSION'S NOVEMBER 28, 2018 SECRETARIAL LETTER INFORMED THE SUBSTANCE FOR THE TESTIMONY PWSA IS PRESENTING HERE.

A. On November 28, 2018, the Commission issued a Secretarial Letter ("November 28, 2018 Secretarial Letter") which: (1) referred PWSA's September 28, 2018 Compliance Plan filing to the Office of Administrative Law Judge; and, (2) established two stages of review for PWSA's Compliance Plan. More specifically, the Commission announced that litigation of "Stage 1" was to commence on November 7, 2018 and the topics to be addressed are "urgent infrastructure remediation and improvement and the revenue and financing requirements of maintaining service that supports public health and safety."[4] In furtherance of this, the November 28, 2018 Secretarial Letter included a list of approximately 120 Directed Questions listed in the PUC Technical Staff Initial Report and Directed Questions (Stage 1). For ease of reference my Exhibit RAW/C-1 reprints these questions and sequentially numbers them. The combined testimony of all the PWSA witnesses are intended to address each of the Directed Questions and all the PWSA witnesses will refer to the numbers on Exhibit RAW/C-1 as appropriate in their testimony. The Directed Questions that I will be covering in this testimony include Directed Questions Nos. 1, 6-15, 17-30, 34-36, 39-43, 51, 61, 82-90, 97-106, and they cover the following areas: I will be responding to the Directed Questions the following specific items: (1) System and Operational Activities; (2) Comprehensive Performance Evaluation; (3) Metered Service; (4) Meters; (5) Unmetered and/or Unbilled Usage (including City Usage); (6) Mandatory Conservation Measures; (7) Standards of Design; (8) Water Conservation Measures; (9) Service Outages; (10) Unscheduled Service

[4] November 28, 2018 Secretarial Letter at 3.

Interruption Compliance (11) Measurement; (12) PWSA's Plan to Address Lead Levels in Water and Replacement of Lead Service Lines; and (13) PWSA's Plan To Address Non-Revenue Water.

Q. WHAT ISSUES DID THE COMMISSION RESERVE FOR STAGE 2 OF THIS PROCEEDING?

A. For Stage 2 of this proceeding, the Commission reserved issues related to (1) PWSA's compliance with Chapter 14 of the Public Utility Code and Chapter 56 of the Commissions regulations; and, (2) the development of a PWSA stormwater tariff. To assist with the processing of Stage 2 issues, the Commission directed staff from the Bureau of Consumer Services ("BCS") and Bureau of Technical Utility Services ("TUS") to conduct workshops open to all interested stakeholders for the purpose of developing further initial reports and directed questions related to these topics to be used for Stage 2.[5]

Q. HOW IS PWSA ADDRESSING ISSUES THAT MAY OVERLAP BETWEEN STAGE 1 AND STAGE 2?

A. PWSA has made its best judgment based on the direction provided by the Commission to determine whether a particular issue is to be addressed in Stage 1 or Stage 2. PWSA recognizes the Commission's intent in staging this proceeding to enable interested stakeholders to have the benefit of the expertise of its technical staff as PWSA works to bring its operations into compliance. As such, PWSA has been very cautious about not raising issues in this Stage 1 testimony that the Commission intends to be addressed in Stage 2. Making this determination, however, has not been cut and dry in all instances (particularly regarding the customer service issues discussed in the testimony of Ms.

[5] November 28, 2018 Secretarial Letter at 4.

Quigley), but I believe the direct testimony we are submitting here fairly places substantive issues in the appropriate staging buckets while also honoring all the commitments PWSA made in the context of the settlement of its recent rate case.

Q. PLEASE EXPLAIN HOW THE RATE CASE SETTLEMENT HAS INFORMED THE SCOPE OF PWSA'S DIRECT TESTIMONY PRESENTED HERE.

A. PWSA filed its first base rate increase filing since coming under the jurisdiction of the Commission on July 2, 2018.[6] In that proceeding, the parties submitted a Joint Petition for Settlement ("Rate Case Settlement") which established rates that PWSA could charge to provide service, required PWSA to immediately address issues specifically identified in the settlement and recognized that other issues identified in the settlement would need to be addressed in this Compliance Plan proceeding. At the time the parties negotiated the Rate Case Settlement, they were not aware of that the Commission would decide to stage its review of the compliance issues. In consideration of this further direction from the Commission, the scope of PWSA's direct testimony here is intended to focus on Stage 1 issues. To the extent the Rate Case Settlement Agreement includes issues that the Commission has determined will be reserved for Stage 2 of this proceeding, we are not submitting any further testimony on those issues here (though, where PWSA agreed to do so in the Rate Case Settlement Agreement, it has provided additional information on these issues in the Compliance Plan Supplement).

Q. WHAT IS THE CURRENT STATUS OF THE COMMISSION'S ACTION REGARDING PWSA'S RATE CASE SETTLEMENT?

A. A Recommended Decision ("RD") was issued on January 25, 2019. In addition to concluding that the Rate Case Settlement was in the public interest and represents a "fair,

[6] The rate case is docketed at R-2018-3002645 and R-2018-3002647.

just and reasonable resolution of the Commission's investigation," the RD recommended that PWSA file "as soon as possible" "corrected tariffs" which address twenty-eight recommended corrections (the "Recommended Corrections") set forth in the RD.[7] Consistent with this, on January 31, 2019, PWSA filed revisions of its tariffs to address the Recommended Corrections. The Commission voted to approve the settlement of PWSA's rate case at its February 7, 2018 public meeting. In a Commission approved Motion of Commissioner Kennard, he noted that the Recommended Corrections involved both typographical errors and substantive issues that would be addressed during this Compliance Proceeding. A final order from the Commission is still pending. The testimony PWSA is submitting here is based on assuming the Commission's Final Order approves the Rate Case Settlement without modification and also addresses (where necessary) any Recommended Corrections to PWSA's tariffs that were specifically reserved for resolution during this Compliance Plan proceeding (and are properly included in Stage 1 issues).

Q. YOU ALSO STATED EARLIER THAT YOUR TESTIMONY IS INTENDED TO SUPPORT PWSA'S LTIIP, CAN YOU PROVIDE ADDITIONAL INSIGHT AS TO WHY THAT IS BEING INCLUDED HERE?

A. Yes. PWSA filed its LTIIP on September 28, 2018 the same day it filed its Compliance Plan.[8] PWSA also included the as-filed LTIIP as Appendix C of its Compliance Plan as directed by the Commission in the Final Implementation Order.[9] Pursuant to the Rate Case Settlement, PWSA also filed a Motion for Consolidation of Proceedings on

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7 RD at 138-139.

8 The LTIIP is docketed at P-2018-3005037 and P-2005039.

9 *Implementation of Chapter 32 of the Public Utility Code Re Pittsburgh Water And Sewer Authority*, Docket Nos. M-2018-2640802 and M-2018-2640803, Final Implementation Order entered March 15, 2018 at 7.

December 14, 2018 to enable the parties and the Commission to review the Compliance Plan and the LTIIP in one proceeding. While that Motion is still pending, many of the issues being addressed in this proceeding and PWSA's LTIIP are interrelated and involve common questions of laws and facts. PWSA believes that reviewing all of these issues together is a prudent way to efficiently utilize the time of the parties and the Commission. While numerous parts of my testimony and the testimony of other PWSA witnesses support PWSA's LTIIP, the last part of my testimony is specifically related to LTIIP issues and Exhibit RAW/C-2 includes PWSA's responses to the January 4, 2019 Staff Data Requests issued in response to PWSA's filed LTIIP.

III. BACKGROUND REGARDING PWSA AND SPONSORSHIP OF ADDITIONAL DOCUMENTS

Q. PLEASE PROVIDE AN OVERVIEW OF PWSA.

A. PWSA is a municipal authority created by the City of Pittsburgh in 1984 pursuant to the Municipality Authorities Act. Though originally created as a financing authority, PWSA has operated as an operating authority since 1995 and has assumed responsibility from the City for the day-to-day management, operation, maintenance, and improvement of virtually the entire City water supply, distribution, and wastewater collection systems. As detailed more fully pages 12 through 18 of PWSA's Compliance Plan, the City's water and sewer systems date back to the 1850s. PWSA has faced numerous and complex issues related to the water and sewer systems including operational issues with the dated infrastructure, the presence of lead, historical contractual relationships, complex organizational and management structures and numerous regulatory requirements and obligations imposed upon PWSA by the state Department of Environmental Protection ("DEP") and the federal Environmental Protection Agency ("EPA"). All of these existed

prior to the passage of Act 65 in December of 2017 which subjected PWSA to the Commission's jurisdiction.

Q. WHY DO YOU BELIEVE THIS CONTEXT IS IMPORTANT HERE?

A. Based on my review of Question 1 of the Staff Directed Questions, I believe it is important to point out that there is a significant amount of history involving PWSA prior to the Commission's jurisdiction that necessarily impacts how PWSA can and will comply with Commission requirements going forward. This history can be gleaned from many of the documents identified by Question Number 1. While PWSA is certainly willing to provide copies of any documents referenced in this list or its Compliance Plan, for purposes of supporting its Compliance Plan, only some of these documents were prepared by either consultants or other third parties and were utilized where appropriate by PWSA to inform decisions on various topics. Other documents are relevant at this point only because they illustrate some of the complex issues faced by PWSA including the audit findings of various entities as well as regulatory orders; however, the views and opinions expressed in those documents are those of the authors and do not necessarily reflect the official policy or position of PWSA.[10] Still other documents are directly related to Stage 2 issues; and, since we will not be addressing those issues in this direct testimony, I am not providing copies of those documents.[11]

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[10] Documents prepared by non-PWSA entities include: (1) The Performance Audit Report by the Office of City Comptroller (Item 1.5); (2) The City-sponsored assessment by Infrastructure Management Group ("IMG") (Item 1.6); (3) The audit by the Pennsylvania Department of Environmental Protection ("PA DEP") (Item 1.7); (4) The audit by U.S. Environmental Protection Agency ("EPA") (Item 1.8); and, (5) The September 18-22, 2017 PA DEP Comprehensive Performance Evaluation for the Aspinwall Water Filtration Plant referenced (Item 1.12).

[11] Documents involving issues related to stormwater include: (1) The Formal Plan to document all stormwater assets and conditions (Item 1.2); (2) Memorandum of Understanding between the City and PWSA for operation, maintenance, repair and capital improvements related to stormwater and the City (Item 1.3); (3) 2017 PWSA prepared responses to the U.S. EPA Municipal Separate Storm Sewer Systems

Q. GIVEN THIS CONTEXT CAN YOU PROVIDE MORE INFORMATION ABOUT THE FOCUSING ON THE FUTURE AND PGH20 2030 PLANS?

A. Yes. PWSA included as Appendix A of the Compliance Plan and attached hereto as Exhibit RAW/C-3 PWSA's "Focusing on the Future: Pittsburgh Water and Sewer Authority's Roadmap to Success."[12] Though developed prior to the Commission's assumption of jurisdiction, this plan sets forth PWSA's goals, the concrete actions that will be taken to achieve these goals, and the measures by which PWSA staff, outside stakeholders, and customers can measure ultimate success. The Focusing on the Future Plan was informed by various reports and findings to include the Report of the Mayor's Blue Ribbon Panel dated December 28, 2017 and the Mayor's Executive Order dated January 22, 2018. I am including copies of these two documents as Exhibits RAW/C-4 and RAW/C-5 because they provide a good overview of the issues facing PWSA prior to the assumption of Commission jurisdiction that PWSA sought to address in its Focusing on the Future Plan.[13] PWSA was further asked by the Mayor of Pittsburgh to outline its view for Pittsburgh's water future through 2030 and beyond. This report, entitled PGH20 2030 was released on November 15, 2018 and covers several areas: (1) PWSA's vision and goals; (2) history of Pittsburgh's water systems and the path that lead to today's current situation; (3) current financial status; and, (4) plans for investing in drinking water, stormwater and sewer infrastructure. A copy of the PGH20 2030 Plan is included

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stormwater permit (Item 1.7); (4) The Wet Weather Feasibility Study (Item 1.13); and, (5) The Green First Plan (Item 1/14).

[12] Included in the Focusing on the Future Plan is PWSA's Organization Plan as requested by Directed Question 1.1.

[13] The various audits referenced in Staff Directed Questions 1.5, 1.6 are summarized in the Report of the Blue Ribbon Panel. I am not including these documents as exhibits as they are publicly available and the only purpose for which PWSA referenced them in the Compliance Plan was to provide historical context and background about how various entities and agencies have evaluated PWSA's operations and issued reports related to these operations.

as Exhibit RAW/C-6. Though PWSA's Focus on the Future and PGH20 2030 Plan were not prepared to set forth how PWSA will satisfy compliance with the Commission's requirements, taken together, they provide a significant amount of PWSA's operational and infrastructure plans in many areas and directly impact PWSA's ability to also revise systems to come into compliance with Commission requirements.

Q. APART FROM THESE ORGANIZATIONAL PLANS, DOES PWSA HAVE AN ENGINEERING PLAN?

A. Yes. The 40 Year Plan prepared by Chester Engineers in 2012 and referenced on page 28 of the Compliance Plan is PWSA's current engineering plan. A copy of this report is included as Exhibit RAW/C-7. As explained in the Compliance Plan on pages 21-22, further study has revealed that the 40-Year Plan significantly underestimated some costs, particularly regarding pipe replacement. PWSA, however, is in the process of updating this engineering plan and the new Water Distribution System Master Plan, Sewer Master Plan and Aspinwall WTP Facilities Plan will supersede the 40-Year Plan. PWSA expects to complete this process by the end of 2019.

Q. HOW DOES PWSA'S CAPITAL IMPROVEMENT PROGRAM ("CIP") FIT IN WITH THE ORGANIZATIONAL AND ENGINEERING PLANS?

A. The CIP provides the detail regarding projects and planned processes to achieve completion. PWSA's most recently published five year CIP covers the period of 2017-2021 and prioritizes the most important infrastructure improvements for water, sewer, and stormwater. This five-year CIP is included as Exhibit RAW/C-8. Each year (usually in the fall) PWSA staff prepares a capital expenditure budget and capital commitment budget that is presented to the PWSA Board for approval for the upcoming year. The update process begins in January with project nominations (from the entire organization). At the completion of the nomination period, the Planning Department screens and

evaluates the nominated projects using a predefined scoring system 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 options, risks, schedule, and the development of a preliminary cost estimate. This process lasts several months and culminates with the presentation of the updated CIP to PWSA's Board of Directors for their approval. Projects that are not selected for execution at any stage will be re-assessed during the next year's CIP development process. This CIP update process enables PWSA to make any changes that may be appropriate regarding priorities and funding given that needs may change from year to year. The 2019 Capital Expenditure Budget and Capital Commitment Budget as approved September 28, 2018 is included as Exhibit RAW/C-9.

IV. INFRASTRUCTURE AND OPERATIONS

A. Capital Projects

Q. PLEASE PROVIDE INFORMATION RELATED PWSA'S CAPITAL PROJECTS AND DISCUSS HOW PWSA IS PLANNING TO ADDRESS COMPLIANCE WITH THE PA DEP OCTOBER 25, 2017 ADMINISTRATIVE ORDER.

A. Please see Exhibit RAW/C-10 which provides information regarding all of PWSA's Capital Improvement Projects including budgeted costs, source of funds,[14] anticipated start and completion dates. Those projects related to the October 25, 2017 Administrative Order of the DEP are highlighted. The DEP October 25, 2017 Administrative Order is included here as Exhibit RAW/C-11. As explained more fully on pages 22 of the Compliance Plan, PWSA is required to undertake a number of tasks pursuant to specific deadlines to ensure that the most urgent water supply projects are

[14] As requested by Directed Question No. 14.

achieved. Regulatory directives and timeframes such as this are used to inform PWSA's prioritization of projects. As part of being regulated by DEP and EPA, PWSA is subject to continued monitoring and evaluation that may lead these agencies to direct PWSA to undertake future capital projects. As that happens, PWSA will re-evaluate its current capital project plans and available resources and make adjustments as appropriate. Thus, while the exhibits that we have prepared in response to these questions are the most current ones, they are subject to change in the future.

Q. PLEASE DESCRIBE PWSA'S PLANS FOR EACH OF THE FACILITIES LISTED IN QUESTION 6 ON EXHIBIT RAW/C-1 (INCLUDING DESIGN ENGINEER, COMPANY AFFILIATION, TIMELINE AND MILESTONE DATES FOR EACH PROJECT).

A. Exhibit RAW/C-12 provides the information requested regarding the specific projects identified in 6.1 through 6.12. Ms. Presutti will provide additional information regarding funding sources and plans.

Q. CAN YOU EXPLAIN HOW PWSA IS ADDRESSING THE OPERATION AND MANAGEMENT OF THE ASPINWALL WATER FILTRATION PLANT PURSUANT TO THE SEPTEMBER 18-22, 2017 PA DEP COMPREHENSIVE PERFORMANCE EVALUATION ("CPE") AS REQUESTED BY DIRECTED QUESTION 15?

A. Yes. PWSA has implemented a large number of modified systems and operational protocols to address these issues related to the Aspinwall Water Filtration Plant as discussed in the DEP CPE. All of the recommended actions and current status of completion for all related tasks are set forth in an internal "Actions Checklist" that is utilized by PWSA Staff. A copy of the most current version of the CPE Actions Checklist is attached as Exhibit RAW/C-13. This Actions Checklist is updated on a daily basis to ensure that progress continues to be made. PWSA is also in regular contact with DEP to ensure that the actions it is taking are consistent with DEP's expectations.

Q. CAN YOU PROVIDE A LIST OF WATER SUPPLY, PRODUCTION AND STORAGE PROJECTS AND WASTEWATER CONVEYANCE PROJECTS WHICH INCLUDES A FIVE YEAR CASH FLOW TABLE AS REQUESTED BY DIRECTED QUESTION NO. 8?

A. Yes, please see Exhibit RAW/C-14 with projects a list of all PWSA capital projects that are tracked for cash flow and includes a five year cash flow table.

B. Competitive Bidding Processes

Q. PLEASE DESCRIBE IN DETAIL THE PROCESS PWSA UTILIZES WHEN SELECTING PROJECTS TO BE COMPETITIVELY BID AS REQUESTED BY DIRECTED QUESTION NUMBERS 9 AND 10.

A. All capital and operation related projects are publicly bid following the requirements of the Municipality Authorities Act ("MAA"). Specifically, 53 Pa.C.S. 5614 provides that any capital construction project or purchase of equipment/materials with a cost in excess of $20,600[15] must follow an open and public bid process. The process includes advertising of the RFP. PWSA also notifies local construction bid service organizations as well as the American Water Works Association ("AWWA") and Water Environment Federation ("WEF").

Q. PLEASE PROVIDE A SAMPLE REQUEST FOR PROPOSAL AND RELATED DOCUMENTS AS REQUESTED BY DIRECTED QUESTION NUMBER 13.

A. PWSA's Technical Specifications Table of Contents template for standard horizontal construction contracts is included as Exhibit RAW/C-15. A copy of the August 2018 Request for Proposal ("RFP") issued by PWSA regarding construction of a redundant rising main to the Lanpher Reservoir located in Shaler Township is included as Exhibit RAW/C-16. Included as Exhibit RAW/C-17 is the Technical Proposal for Aspinwall Pump Station to Lanpher Reservoir Rising Main dated September 18, 2019 and submitted

[15] This amount is adjusted each year. The 2019 dollar amount calculated by the Department of Labor and Industry is specified in 48 Pa.B. 7354.

by Michael Baker International, Inc. Exhibit RAW/C-18 is the Best and Final Offer that was submitted by Michael Baker International on October 31, 2018. PWSA ultimately awarded the contract to Michael Baker International. Exhibit RAW/C-19 is the executed Professional Services Agreement with Michael Baker International. I am including these documents to illustrate the level of detail and information that PWSA requires and considers in awarding its construction projects.

Q. ARE THERE EXCEPTIONS TO THE TYPICAL PUBLIC BIDDING PROCESS UTILIZED BY PWSA FOR CAPITAL PROJECTS?

A. The only projects not competitively bid are those which require emergency action to mitigate public health or safety risks or those for which the amount is below the threshold for bidding per the MAA. Emergency projects can be declared when regulators demand immediate action and short completion timeframes. Emergency projects can avoid long procurement delays that may hamper the ability to address equipment or facility failures and avoid delays that may normally occur to procure needed equipment and materials. However, even under such circumstances, PWSA will compare bids to consultant estimate of work and past contractor bids received for similar work.

Q. DOES PWSA HAVE AN EXISTING CONTRACTOR PRE-QUALIFICATION PROCESS IN PLACE AS ASKED BY DIRECTED QUESTION 11?

A. Contractor prequalification is performed in those instances which require a unique capability or specialized expertise, such as installation of water treatment membranes or specialty lining of water mains and sewers. PWSA requires contracts to satisfy the Davis Bacon Wage Act (40 U.S.C.S. §§ 3141-3148) with all their employees on projects. Under certain circumstances, PWSA will require verification that the Project Superintendent is prequalified to direct the construction work of the contract. A recent example is the requirement that the Lead Service Line Contractors have Site

Superintendents who maintain certain qualifications and experience in Lead Service Line removal and installation of new service lines.

Q. HOW DOES PWSA EVALUATE CONTRACTORS FOR COST-EFFECTIVENESS?

A. Cost effectiveness is assessed by comparing bids of several contractors. In the formal process, cost estimates are provided by the Design Engineer based upon the final Design Drawings and Specifications. PWSA also maintains a record of all bids and subsequent final pay applications to further verify the pricing acceptability of any particular bid. With rare exception, PWSA will award to the lowest eligible and responsible bidder. Circumstances of imbalanced bids or other bid abnormalities (e.g., equipment substitutions, etc) may disqualify a bidder, or they may be asked to withdraw their bid. Also, PWSA reviews the performance and experience of the Site Superintendent to ensure that the Contractor has the expertise to complete the project on time and budget. Contractors may be disqualified for other reasons as outlined in the MAA.[16]

Q. HOW ARE PROFESSIONAL AND CONSULTANT SERVICES SECURED?

A. To acquire professional services, PWSA follows a process that is based upon quality of services as well as cost. PWSA will issue an RFP inviting qualified firms to submit a response. The final selection is based on a series of selection criteria which evaluates the firm's qualifications and experience, the individual project manager to perform the work, performance of the firm on other client's projects, the understanding of the project and the proposed scope of work, involvement of minority/women's/veteran's/disabled veteran's businesses and proposed costs. Consultants are selected by a specified PWSA

[16] See 53 Pa.C.S. § 5614(a)(3), (a)(4), (b).

Selection Team approved by the Executive Director and ratified by a PWSA Board resolution approval. PWSA has also established twelve firms as "On Call Consultants." These On Call Consultants can be awarded project work without a formal RFP process, though often several firms are requested to submit a proposal to outline their proposed staff, scope of work and costs to complete the project. Any project cost must have prior approval by the PWSA Board which includes authorization of a Capital Improvement Project Scope and Budget. Moreover, any Task Order under these On Call Agreements in excess of $100,000 must be approved separately by the PWSA Board. Unless otherwise approved by the PWSA Board, the Consultant Services in excess of $1 million are subject to the formal RFP process as described above.

C. 52 Pa. Code § 65.17 - Standards of Design – 4-Inch Diameter Mains

Q. PLEASE DESCRIBE WHERE THE 27 MILES OF 4-INCH DIAMETER MAINS EXIST IN PWSA'S DISTRIBUTION SYSTEM.

A. Existing 4-inch diameter mains are located through the distribution system as shown on Exhibit RAW/C-20.

Q. WHEN DOES PWSA PLAN TO HAVE THE 27 MILES OF 4-INCH DIAMETER MAINS REPLACED WITH PIPE OF 6 INCHES OR GREATER?

A. The 2019 and 2020 Small Diameter Water Main Replacement Program ("SDWMRP") prioritized 4-inch diameter mains for replacement. Future prioritization matrices will also include scoring for 4-inch mains.

D. 52 Pa. Code § 65.7 – Metering Unmetered Properties

Q. PLEASE SUMMARIZE PSWA'S PLAN FOR METERING CUSTOMERS (WHICH IS SET FORTH IN THE COMPLIANCE PLAN) AS REQUESTED BY QUESTIONS 17 TO 20 ON EXHIBIT RAW/C-1.

A. PWSA has a plan to install meters and associated equipment for 200-400 municipal buildings within the City, as well as 500 flat rate customers. To support this initiative,

PWSA anticipates hiring professional consultants for the redesign of existing building plumbing as needed, and dedicating PWSA plumbers as well as outside contractors to coordinate with the City, oversee scheduling building access, design the meter facilities, and manage the contractor for the duration of the project. PWSA is in the process of securing an engineering consultant to assist with inspecting and sizing the required metering facilities. PWSA will employ a contract plumber to install plumbing as agreed with the City. Because of the variation in sites and meter needs, PWSA anticipates that it will take approximately five years to be in full compliance. PWSA estimates that this project will cost approximately $35 million over five years, but hopes to recover some of the associated costs from the City.

Q. HOW DOES PWSA PLAN TO IMPLEMENT RATES FOR UNMETERED AND/OR UNBILLED MUNICIPAL BUILDINGS?

A. With regard to unmetered and/or unbilled municipal buildings, PWSA proposes to implement rates over five years (a "phased-in" and "stepped" approach). As meters are installed, PWSA will begin to charge these customers for service, based on meter readings on a "20-40-60-80-100" basis. In this manner, the implementation of rates will be "stepped." As more locations are metered, PWSA will apply this same phase-in, which will increase the total usage and the money collected (the "phase-in"). This proposal is discussed in more detail in Section E of my Testimony.

Q. PLEASE EXPLAIN PWSA'S CURRENTLY PROJECTED TIMELINES.

A. Each year, PWSA will install a certain number of meters in accordance with its present plan. PWSA's proposed multi-step, multi-year plan to address the unmetered locations, is described in the LTIIP and summarized in Table 13 of the Compliance Plan. However, the dates identified in the Compliance Plan have shifted as PWSA's meter installation plan has evolved. The current timeframe for metering locations is as follows:

Table 1: PWSA plan to address unmetered locations

TASK	END DATE FOR COMPLETION
Release RFP for design consultant	February 28, 2019
Award RFP To Consultant	May 15, 2019
Identify all locations where service is either: a) unmetered entirely; or b) metered but not billed.	December 31, 2019
Have one (or more) plumbing contractors under contract	April 1, 2020
Install meter sets in accordance with PUC tariff	December 31, 2023
Begin to bill all unbilled and/or unmetered locations	December 31, 2023
Begin to collect fees billed	20% of the total bill will be due in first year, 40% of total bill in second year, and so on, until amounts due fully reflect billed amounts

Q. PLEASE EXPLAIN WHY THIS TIMELINE HAS BEEN ADJUSTED?

A. As PWSA continues to move forward with this type of project, issues arise that need to be addressed and which can result in the need for PWSA to adjust timeframes or reset expectations. PWSA's metering plan is a substantial project that is dependent on factors outside of PWSA's control (such as the cooperation of building owners, the negotiations with the City of Pittsburgh and that ability to find a sufficient amount of human resources to perform the work). While these factors alone can and do result in the need for PWSA to continue to evaluate whether or not its projected target dates are realistic, PWSA also has many other projects and priorities that have to be taken into consideration. I discussed earlier many of the other infrastructure projects and efforts that PWSA has to

undertake due to regulatory requirements. I will also discuss later PWSA's lead remediation projects which also require time and personnel to implement. All of these issues are in addition to bringing PWSA's systems and operations into compliance with Commission regulatory requirements. With all of these projects and tasks, PWSA needs flexibility to reprioritize and shift anticipated timelines when necessary to ensure that all projects are handled and that priority items can be addressed.

Q. CAN THE 5-YEAR TIME HORIZON FOR THE METERING OF MUNICIPAL BUILDINGS POSSIBLY BE ACCELERATED AND, IF SO, HOW?

A. Yes, I believe PWSA may be able to complete the metering of municipal buildings within two to three years, if City resources are mobilized to provide all interior building plumbing upgrades prior to scheduling meter installation. PWSA intends to assign a project manager to an un-metered city account on a case-by-case basis, due to all the rerouting and customizing of plumbing that is necessary to prepare in order to be able to install the meter set. The project manager will be responsible for all of the scheduling, planning, and site visits and will ensure that all of the proper materials and equipment are on-hand to execute the metering of the municipal buildings in a timely manner. Once staff has been assigned to all unmetered city accounts, I believe PWSA can have all these properties metered within two to three years. However, I believe that notwithstanding these projections, it would be prudent to set the time frame for completion of this project nonetheless at five years, especially in consideration of the fact that PWSA also needs to install meters for approximately 500 flat rate customers.

Q. PLEASE EXPLAIN WHY PWSA BELIEVES ITS PROPOSED PLAN AND CURRENT TIMELINE TO METER UNMETERED PROPERTIES IS REASONABLE.

A. The Compliance Plan explains the necessity to implement rates over a five year period for unmetered and/or unbilled City usage, as follows: "As new meters are installed, PWSA customer service staff will create accounts, track water consumption and begin the billing process. The City's bills will then be restricted, based on the phase-in approach, which is appropriate because the City has never been billed for water at these locations, and is neither aware of the amount of water they use, nor the dollar amount it will have to pay once billing for the water begins. The City needs a reasonable amount of time in which to understand what these obligations will be and to consider taking steps to try to mitigate its current water use. The City also needs lead time to incorporate these payment obligations in future budgets." Compliance Plan at 110-111.

PWSA's plan for meter installation is also reasonable, in consideration of the following: 1) the timeframe that is necessary in light of the variation and size of meter needs and the availability of qualified personnel or contractors to install and supervise the installation; 2) the number of currently unmetered customers; 3) the efforts that will be needed to make the locations suitable for meter installation; and 4) the fact that the plan will result in full compliance with the Commission's requirement that PWSA provide metered service to all customers in a specified time period.

Specifically, prior to coming under Commission regulation, PWSA offered a fixed, monthly rate for unmetered service. As such and as noted above, as of this date, there are approximately 500 (non-City) flat rate customers that are not metered. Some of these private establishments are derelict buildings that may be torn down prior to meter

installation. PWSA is still in the process of evaluating and determining the current and future status of these buildings.

Further, as noted, there are approximately 200-400 City-owned and/or operated locations where PWSA either does not bill the City for water service or where it neither meters nor bills the City for water service. These unmetered municipal buildings are the result of the existing Cooperation Agreement between the City and PWSA, wherein PWSA agreed to provide up to 600 million gallons per year of unbilled water to the City. Because the plumbing at some of the non-metered locations was not designed to accept meters, a significant amount of re-plumbing and/or construction may be required at some sites. This may consist of installing new plumbing fixtures, pipe and valving, constructing meter pits, and/or building facilities to satisfactorily house meters and appurtenances.

The variation in sites and meter needs, as well as the number of currently unmetered customers, increases the time and resources that are necessary to complete this project. PWSA's schedule for metering also depends upon our ability to hire additional staff plumbers to minimize the costs of contracted work, and to inspect the contractor's work, as well as coordinate County plumbing inspections. With the assistance of the contractors, PWSA expects to be in full compliance with the metering requirement in approximately five years, although, as noted above, PWSA may be able to complete the project in two – three years.

Q. WHY ARE CONTRACTORS NECESSARY FOR THIS PROGRAM?

A. Again, the variation and size of meter needs, as well as the number of currently unmetered customers, increases the time and resources that are necessary to complete this project. PWSA does not have sufficient plumbing and field staff to engage in a meter

installation program of this magnitude at this time. (As explained more fully in the testimony of Ms. Lestitian, PWSA's current domicile requirements have also hindered our ability to hire trade staff, including plumbers.) It should also be noted that, in addition to the contractors, PWSA plans to hire two additional customer service representatives to support customer scheduling and new account management activities.

Q. PLEASE DESCRIBE PSWA'S CURRENT PRACTICE REGARDING THE FINANCING OF METER INSTALLATION.

A. PWSA's current practice is that applicants (e.g., new customers) pay for the meter, meter installation and other related appurtenances — in all instances. The meter and any appurtenances are then owned, installed, tested, and maintained by PWSA. That being said, customers do not need to pay for the replacement of meters or appurtenances.

Q. CAN YOU DISCUSS THE PROVISIONS IN THE PUBLIC UTILITY CODE REGARDING THE FINANCING OF METER INSTALLATION?

A. Yes. I am informed by counsel that the Public Utility Code does not provide for a specific charge for meter installation or other related appurtenances. Instead, the Public Utility Code generically provides that every charge (or "rate") made, demanded or received by any public utility — for any service provided under the Public Utility Code — be just and reasonable, and that there may be no unreasonable preference or prejudice to any customer. See 66 Pa.C.S. §§ 102, 1301, 1304.

I am also informed that nothing in the Public Utility Code expressly prohibits a charge for meter installation, meters or meter pits provided by a public utility. Nor do the Commission's Regulations. For example, 52 Pa.Code § 65.7(b) states a general rule that the utility should provide the meter (at the utility's expense), but it expressly provides that the Commission can authorize a departure from that general rule. So, the property owner may be responsible for meter installation, meters or meter pits. When that is the

case and the utility performs such services, the utility is entitled to be compensated for its work and materials.

Further, I am informed by Counsel that nothing in the Public Utility Code expressly prohibits a charge for backflow prevention devices provided by a public utility. Nor do the Commission's Regulations. In fact, the Commission issued a policy statement which states that: "Costs for backflow prevention devices ... shall be borne by the applicant for service on a one-time basis." 52 Pa.Code § 69.169. Consistent with the policy, Rule 11.6 in York Water's Water Tariff provides that the customer is responsible for installing approved devices to prevent backflow. Additionally, I would note that the DEP has issued a regulation providing that: "It shall be the responsibility of the customer to eliminate cross-connections or provide backflow devices to prevent contamination of the distribution system from both backsiphonage and backpressure." 25 Pa.Code § 109.709(a)(1). The property owner is responsible for backflow protection. So, if a utility performs any services related to backflow prevention, the utility is entitled to be compensated for its work and materials.

I am also advised by Counsel that nothing in the Public Utility Code expressly prohibits a charge for additional plumbing provided by a public utility. I read the appurtenance example of "additional plumbing" as referring to work and materials related to internal piping within a home or building. The property owner is responsible for internal piping. So, if a utility performs any services related to internal piping, the utility is entitled to be compensated for its work and materials.

Q. DO THE PROVISIONS IN PWSA'S TARIFF ADEQUATELY ADDRESS THE REQUIREMENTS FOR METER INSTALLATION AND RELATED APPURTENANCES?

A. Yes, PWSA's proposed tariff adequately addresses requirements for meter installation and other related appurtenances. PWSA's tariff, which was approved by the Commission in its rate case at Docket Nos. R-2018-3002647, *et. al.*, provides that PWSA will develop and implement a metering plan which will identify all unmetered customers/accounts and provide for plans and timeframes for metering of all unmetered customers/accounts. This provision is consistent with PWSA's plan to install meters for all customers in order to comply with Commission regulations. Under PWSA's tariff, PWSA's non-metered customers will be required to pay a Customer Facilities Fee, which will include charges for the meters, the remote reading devices, and their installation.[17] As discussed, this proposed charge is consistent with the Public Utility Code. PWSA, however, hopes to recover some of the associated costs (e.g. additional plumbing, meter pits, backflow prevention devices, etc.) from the City.

Q. WHY IS IT REASONABLE TO REQUIRE APPLICANTS TO COVER THE COSTS OF INSTALLING A METER, METER PIT, BACKFLOW DEVICES OR AND OTHER METER RELATED EQUIPMENT?

A. Having customers pay this cost will enable PWSA to use its available construction capital to focus on the numerous safety and reliability-related projects. While PWSA is committed to having 100% of its water service metered, it must prioritize its available capital to focus on more health and safety related projects that impact a large cross-section of our ratepayers.

Q. PLEASE DISCUSS COMPLIANCE WITH THE PROVISION OF 52 PA CODE SECTION 65.7(B) REQUIRING NOTICE TO CUSTOMERS ABOUT THE

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[17] *See* PWSA Water Tariff at 42.

RESPONSIBILITIES OF THE CUSTOMER AND PWSA REGARDING METERS.

A. I am advised by counsel that Section 65.7(b) of the Commission's regulations provides that it is the customer's responsibility to properly protect the meter from damage, and the customer is held responsible for repairs or replacements of the meter as a result of negligence or an intentional act of the customer. Utilities seeking to impose responsibility for damage to the meter must provide the customer with notice explaining the proper maintenance of meters. This Notice must be provided in the utility's Rules and Regulations.

PWSA's current tariff specifically provides that protection for the meter and meter reading equipment shall be provided by the customer. The tariff further provides that meters shall be maintained by the Authority so far as ordinary wear and tear is concerned. The tariff further states, "Where damage to a meter results from the negligent or willful act of the customer, the actual cost of removing, replacing, repairing or testing a damaged meter shall be paid by the customer."[18]

E. Implementing Rates For Unmetered and/or Unbilled Usage (including City Usage)

Q. PLEASE DESCRIBE PWSA'S PLAN FOR IMPLEMENTING RATES FOR ALL UNMETERED AND/OR UNBILLED CITY USAGE.

A. As discussed, PWSA is aware of between 200-400 City-owned and/or operated locations where it either does not bill the City for water service or where it neither meters nor bills the City for water service. PWSA estimates that all unbilled and unmetered facilities can be metered within five years (and possibly 2-3 years for municipal buildings) and

[18] *See* PWSA Water Tariff at 42-43.

proposes to implement rates for City-owned facilities by a "phased-in" and "stepped" approach, with the City not fully billed until the fifth year of the plan.[19] The phasing installs meters over time at City locations, and the "steps" move towards fully billing the City. It should be noted that, not only will the percentage of billing increase each year, but the total usage will increase as more locations become metered. So, in effect, the money collected by PWSA from City-owned properties will increase by more than 20% each year.

This approach is being negotiated with the City as part of the Cooperation Agreement. It is my understanding that the City needs time to adjust to what would be significant new charges to the City. In most of these instances, the City has no information as to what its consumption is.

Q. IS THAT PLAN REASONABLE AND APPROPRIATE?

A. Yes. Regarding the 20/40/60/80/100 percent phased and stepped billing approach, this approach is appropriate because the City has never been billed for water at these locations, and is neither aware of the amount of water it uses nor the dollar amount it will have to pay once billing for the water begins. The City needs a reasonable amount of time in which to understand what these obligations will be and to consider taking steps to try to mitigate its current water use. The City also needs lead time to incorporate these payment obligations in future budgets.

[19] Meters will be billed consistent with the % then in effect. So, for example, a new meter installed during the year the 40% is in effect would be billed at 40%.

Q. PLEASE DISCUSS THE ESTIMATED REVENUE LOSS ASSOCIATED WITH UNMETERED AND UNBILLED USAGE.

A. It is difficult to make an accurate estimate for the City and City-affiliated locations. The City is the only real unmetered issue. Half of the City's major facilities have meters and get measured. For last year, those measurements would equate to about $3.6 million in billed usage. But, that is only part of the picture. The key City and City-affiliated facilities that do not have meters are the Zoo and swimming pools and spray parks. There is presently no good method of estimating the use at those locations.

In addition, the City also owns a lot of buildings by default. A certain percentage of those buildings are derelict and will be torn down by the City. So, buildings there today, may not be there in six months. Since PWSA lacks information on these buildings, it is difficult for PWSA to estimate usage, if any, at such locations.

Q. PLEASE PROVIDE PWSA'S VIEW OF THE LEGALITY OF THE PROPOSED PWSA STEP BILLING APPROACH.

A. While I am advised by counsel that failing to meter and/or failing to charge some locations but not others, is inconsistent with the Public Utility Code as well as the Commission's Regulations, I am advised that the phase-in approach is consistent with Act 65, which states that the Commission will approve a plan for coming into compliance.[20] The Commission also is empowered to suspend or waive the applicability of any provision of the Public Utility Code, except for 66 Pa.C.S. § 3202 (regarding application of provisions of Public Utility Code). See 66 Pa.C.S. § 3202(b).

Q. PLEASE DISCUSS THE FEASIBILITY OF ESTIMATING USAGE BASED ON ENGINEERING ESTIMATES ON ALL CURRENTLY UNMETERED

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[20] *See* 66 Pa. C.S. § 1303-1304; 66 Pa.C.S. § § 3204(b).

CUSTOMERS AND BILLING IMMEDIATELY BASED ON THOSE ESTIMATES.

A. It is not feasible for the City and City-affiliated locations. There are a few estimated bill situations not involving the City, but those customers are being charged by PWSA. The City is the only real unmetered issue. As I discussed, it is difficult to make good estimates of usage for the City.

Q. PLEASE DISCUSS WHETHER INITIATING THE 20/40/60/80/100 PERCENT STEP BILLING PROPOSAL IMMEDIATELY BASED ON THOSE ENGINEERING ESTIMATES WOULD BE FEASIBLE AND LEGAL.

A. It is not feasible for the City and City-affiliated locations. If PWSA begins to immediately bill 100% of the City locations with meters, the City will face significant new charges from PWSA. The City likely would not be in a position to remit these funds, given that they have not budgeted these costs previously. As I explained, the City needs lead time to incorporate these payment obligations into its budget(s). Imposing significant bills to the City that go unpaid by the City will not increase revenues to PWSA. We intend to incorporate this payment plan in the City – PWSA Cooperation Agreement.

Q. PLEASE DISCUSS WHETHER ANY 20/40/60/80/100 PERCENT BILLING PROGRAM SHOULD BE PHASED AS OPPOSED TO STEPPED.

A. As discussed, under PWSA's proposal, the 20/40/60/80/100 percent billing program is both phased and stepped. Phasing means that as buildings have meters installed, the total number of meters billed will immediately increase. Stepping of the annual billing is needed so that the City has time to incorporate these payment obligations into its budget(s). Moreover, we anticipate that the City will begin assessing ways to conserve water to manage its annual costs, so providing an escalation of bills over time will allow the City to dedicate some funds to the conservation efforts. As I have explained above,

the issuance of significant bills to the City for usage by the City and City-affiliated locations that go unpaid by the City will not increase revenues to PWSA.

Q. PLEASE DISCUSS THE FEASIBILITY OF IMMEDIATELY APPLYING THE MONTHLY CUSTOMER CHARGE TO ANY KNOWN BUT UNBILLED OR UNMETERED CUSTOMER PRIOR TO THE INSTALLATION OF A METER.

A. PWSA is currently applying the customer charge to all unmetered flat-rate customers. It is not feasible for the City and City-affiliated locations, for the reasons I have explained. The City needs lead time. The issuance of significant bills to the City for usage by the City and City-affiliated locations that go unpaid by the City will not increase revenues to PWSA.

Q. PLEASE DISCUSS THE FEASIBILITY OF IMMEDIATELY IMPLEMENTING A METER TRIAGE PLAN FOR ALL UNMETERED PROPERTIES WITH THE FOLLOWING HIERARCHY: 1) METERING/ESTIMATING AND BILLING HIGH VOLUME CUSTOMERS; 2) METERING/ESTIMATING AND BILLING MID-VOLUME CUSTOMERS; AND 3) METERING/ESTIMATING AND BILLING LOW-VOLUME CUSTOMERS.

A. PWSA is currently using a triage plan with the identified hierarchy. First, almost all of PWSA's large- and mid-volume customers (as well as party lines) are currently metered/receive estimates and bills, except for City properties and city-affiliated properties that fall under the existing cooperation agreement between the City and PWSA. As discussed, PWSA estimates that it will be able to meter all customers within five years, and anticipates that it may be able to complete the metering of municipal buildings within 2-3 years. I would note that prior to completing all meter testing, there is no way to determine how slowly a meter is running; if PWSA is not receiving accurate reads, customers may be placed into the wrong "bucket" in terms of hierarchy.

Second, regarding unmetered properties, if there is any reasonable way to estimate a bill, then PWSA estimates bill(s) for that customer. With the exception of the

City and City-affiliated properties, PWSA uses estimates for all customers (including, high-volume customers, mid-volume customers, low-volume customers, and residential customers).

Q. ARE ANY OF THE 200-400 CITY-OWNED AND/OR OPERATED LOCATIONS THAT ARE UNBILLED FOR WATER SERVICE BILLED FOR WASTEWATER SERVICE?

A. Customers who are not billed for water are not billed for wastewater. PWSA pays the cost of wastewater treatment for those customer through PWSA's arrangement with ALOCSAN. The 20/40/60/80 Plan will apply to wastewater charges as well.

Q. HOW DOES PWSA PLAN TO ADDRESS AND IMPLEMENT CHARGES FOR PUBLIC FIRE HYDRANTS?

A. PWSA plans to address charges for public fire hydrants in its next base rate proceeding.

F. 52 Pa. Code § 65.78 – Meter Testing

Q. ON PAGES 56-58 OF THE COMPLIANCE PLAN, PWSA INDICATES THAT IT HAS AS MANY AS 50,000 METERS OUT OF COMPLIANCE WITH COMMISSION METER TESTING REQUIREMENTS AND PLANS TO ACHIEVE COMPLIANCE BY 2022.

PLEASE EXPLAIN WHY PWSA BELIEVES THAT THE 2022 COMPLIANCE GOAL IS REASONABLE AND APPROPRIATE.

A. The 2022 goal has been reviewed, and we now believe that the meter changeout can be completed by June 30, 2024 though, for the reasons I discuss further, this is a moving target and I would caution against holding PWSA to a firm, unmovable deadline. However, based on our current analysis, there are approximately 50,000 residential meters that are out of compliance with the Commission's meter testing requirements. In order to comply with the Commission's meter testing and replacement requirements, PWSA will assign two of our existing plumbers, and will need to acquire four additional new plumber hires, who will be dedicated to work approximately 240 days per year in

furtherance of the meter testing program. PWSA will also need to purchase four additional vans, tools, and I-pads and will need to determine where to house these new employees. It is anticipated that each plumber will be able to test and replace, if necessary, a minimum of six residential meters per day, for a total of 8,640 per year for all six assigned plumbers. PWSA anticipates that it will be able to test and replace an additional 1,360 per year from its day-to-day operations plumbers. Therefore, the total service meter testing/installations is estimated to reach 10,000 per year. As such, a total of five years of will be required to complete the 50,000 meter replacements. Based on this analysis, PWSA respectfully requests that the deadline for completion for this program is more realistically June 30, 2024, noting however that this date may need to be shifted as work progresses. I am hopeful that if meter replacement production exceeds the current estimate, the work could possibly be completed by the end of 2023. However, for the reasons explained earlier regarding PWSA's plans to install meters for unmetered properties, PWSA needs the flexibility to be able to continually monitor its progress and to shift priorities where appropriate. Moreover, PWSA's hiring limitation due to the current domicile policy impedes our ability to locate and hire qualified licensed plumbers. If staff plumbers are not available, PWSA will hire contract plumbers to complete the work by the proposed deadline.

I would note that the plan that I just described does not deal with large (greater than 2") and intermediate (1.5" – 2") commercial meters. The testing of those meters will likely be conducted by a separate project manager or done by third parties under contract with PWSA, as described in more detail below.

Q. HAS PWSA CONSIDERED COMPLYING WITH THE COMMISSION'S METERING REQUIREMENTS THROUGH DETAILED YEAR-OVER-YEAR COMPLIANCE SCHEDULES AND SUPPORTING DOCUMENTATION?

A. Yes, PWSA intends to continue an annual meter replacement program to remain in compliance with the PUC requirements. We will retain the necessary staff to achieve a changeout of up to 5,000 meters per year. (This rate has been sustained with existing staff in 2018.)

Q. IN THE COMPLIANCE PLAN, PWSA HAS INDICATED THAT IT HAS A GOAL TO TEST AND REPLACE 10-25% OF THE 2,800 COMMERCIAL METERS ON AN ANNUAL BASIS.

IN PWSA'S VIEW, IS THAT ADEQUATE TO ACHIEVE COMPLIANCE BY THE 2022 GOAL?

A. Yes. In addition to the residential meters described above, there are approximately 3,300 commercial accounts with meters of 1" or greater (approximately 2,800 of which are 1.5" or greater, and approximately 450 of which are greater than 3") that are out of compliance. The testing and replacement of these oversized meter accounts will be conducted by a separate project manager, who will be responsible for the scheduling, planning, and site visitation to ensure that all of the proper materials and equipment are on-hand to execute these large accounts in a timely manner. PWSA intends to dedicate four plumbers from its current staff to test and replace these oversized accounts. PWSA anticipates that its staff will be able to test and replace, if necessary, 4.58 commercial accounts per day (approximately 2 changes per crew), or 1100 commercial accounts per year, which would amount to a three-year turnaround.

Q. DOES PWSA HAVE ANY FORMULAS TO ESTABLISH RATES FOR TESTING METERS LARGER THAN 2 INCHES?

A. PWSA will monitor the usage of water meters larger than 2 inches, along with the age, and will then test or replace as required by Commission regulations. Nominally, PWSA expects to test or replace meters to achieve the required maximum service life.

Q. DO ANY METERS WITHOUT TEST RECORDS EXIST WITHIN THE SYSTEM?

A. Yes, PWSA estimates that it has meter test records for less than 1% of its approximately 81,000 water meters. PWSA lacks data regarding meter age by type and size for meters installed prior to 2017 because the meter register numbers were being recorded in place of the meter body/serial numbers. Since 2017, all new meters purchased have the testing results from the manufacturer, and the records should be on file at the warehouse or with customer services. Additionally, from 2016 to present, a total of 10,705 meters have been replaced with new meters with appropriate performance test records from the manufacturer. In addition, we are testing 10 percent of the new meters as delivered. PWSA is also in the process of updating its systems and installing a new meter testing bench which, when operational, will enable PWSA to more efficiently track meter test results.

Q. PLEASE DISCUSS THE ADEQUACY OF THE METER TESTING FACILITIES PROPOSED AND CURRENTLY AVAILABLE.

A. All current operations facilities are full with staff and equipment. PWSA is in the process of realigning its current warehouse facility to house a new meter test bench for meters 2 inches and smaller. An existing employee will be assigned to perform these tests using the new equipment.

G. 52 Pa. Code § 65.11 and §65.20- Water Conservation Issues

Q. CAN YOU PROVIDE PWSA'S PERSPECTIVE AS TO WHETHER THE PROVISIONS FOR VOLUNTARY AND MANDATORY WATER RESTRICTIONS ARE ADEQUATELY ADDRESSED BY PWSA'S PROPOSED TARIFF?

A. Yes. Conservation measures are discussed in the Compliance Plan. See Compliance Plan at 59-60. The Tariff provisions adequately address voluntary and mandatory water restrictions. That being said, I would note that PWSA is in a water-rich location and has rarely needed to impose water conservation measures on its customers. PWSA has not developed specific standard operating procedures for situations that require mandatory conservation measures as such procedures have not been necessary in at least the past ten years. PWSA is currently evaluating how to address the requirements of Section 65.11 in the context of revising its Emergency Response Plan ("ERP") and anticipates that completion of this process by 2020 is a reasonable timeframe. In the event such conservation measures are required, PWSA will notify customers via traditional lines of communication which include automated telephone calls, social media, and the website.

Q. PLEASE DESCRIBE HOW PWSA PLANS TO MEET THE SECTION 65.20 WATER CONSERVATION STANDARDS.

A. PWSA's water resources are sufficiently abundant that water conservation is not a key aspect of its water supply plan. PWSA does however plan to undertake a number of steps to educate customers on water conservation steps that they can take. These steps could be useful to customers in helping to utilize water efficiently and to potentially reduce the variable portion of their bill. Those steps include: 1) educational brochure at least once a year; 2) annual water audits for large users; and, 3) customer notification regarding water-saving plumbing fixtures. On the system side, PWSA's plans include: 1) reducing unaccounted for water within reasonable amounts (less than 20%); 2) installing a system

of leak detection; 3) conducing distribution system zone studies to identify higher leaking zones; and, 4) the above described individual customer metering program.

H. Non-Revenue Water, Leak Detection and Leak Surveying

Q. THE CP AT PAGE 121-122 INDICATES THAT PWSA IS NOT ABLE TO MAKE A MEANINGFUL ASSESSMENT OF ITS NON-REVENUE WATER (NRW) BECAUSE IT LACKS AN ACCURATE MEANS OF DETERMINING FLOWS INTO AND OUT OF THE WATER DISTRIBUTION SYSTEM. THEREFORE, PWSA ESTIMATES NRW AT 50% OF WATER PRODUCED AND PLANS TO HAVE METERS IN PLACE BY 2021. PWSA ALSO PLANS TO IMPLEMENT A COMPREHENSIVE LEAK SURVEYING PROGRAM CONSISTENT WITH AWWA STANDARDS AND PROCEDURES. [21]

COULD YOU PLEASE PROVIDE THE PWSA DEFINITIONS OF NRW AND LOST AND UNACCOUNTED FOR WATER?

A. PWSA is using the term NRW consistent with the American Water Works Association (AWWA) manual: M36 Water Audits and Loss Control Programs, Fourth Edition (2016) ("M36"). See Compliance Plan at 121-122.

The M36 includes the International Water Association (IWA)/AWWA Water Balance Table, which defines water loss as the difference between the volumes of water supplied to a system and authorized consumption within that system. Total water loss is defined as the sum of apparent and real losses.

According to the M36, Apparent loss can result from inaccuracies associated with metering errors, systematic data handling errors, data gaps, misreported data, unauthorized consumption (theft), estimated volumes due to lack of metering, and similar nonphysical (paper) losses; and real losses are physical water losses that can result from

[21] In addition, the Directed Questions state that PWSA's 40 Year Plan of 2012 indicates at page 4-36, table 4-2 that while domestic average daily metered consumption has declined approximately 64% from 1996 to 2009 consistent with declines in population (page 4-35, figure 4-48), domestic average daily unmetered consumption increased over that time. Also, table 4-2 shows that unaccounted for water increased approximately 144% and the Other category increased approximately 682% over that same period.

leaking water mains and service connections, storage tank overflows, water flow from damaged pipelines and the like, reported or not.

Q. HOW DO THOSE DEFINITIONS DIFFER FROM THOSE COMMONLY USED BY THE COMMISSION?

A. The definitions commonly used by the Commission for UFW are similar to the above-described definition of NRW. The Commission has stated that UFW is the difference between the total system output and the metered quantity of water billed, plus an estimate used for fire service, testing, main flushing and company use.[22]

I would note, however, that the M36 defines UFW differently than the Commission. Under the M36, UFW is water treated at a water treatment facility, but is not billed, measured or estimated through accepted AWWA practices. *See* Compliance Plan at 121, fn79. Since 2003, AWWA has recommended against the use of the imprecise term UFW because it does not exist in the best practice water audit method, and its use creates more confusion than guidance to water utilities.[23] Instead, the precisely defined term NRW should be employed, as given in the M36. The use of non-preferred and preferred terminology is given in Table 1-1 of M36.

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22 *PUC v. Total Environmental Solutions, Inc.*, Docket No. R-00072493, et al., Opinion and Order entered July 30, 2008; 2008 Pa. PUC LEXIS 1227: Unaccounted-for-water is the difference between the total system output and the amount of metered water that is billed, plus an estimate used for fire service, testing, main flushing and company use. Unaccounted-for-water is commonly caused by under registration of meters, system leaks, theft, and natural losses. Although the Commission permits a reasonable amount of unaccounted-for-water, its policy statement on water conservation cautions that it has found levels above 20% to be excessive. 52 Pa Code §65.20(4). *See also Pennsylvania Public Utility Commission v. Dauphin Consolidated Water Supply Company*, 55 Pa.P.U.C. 202 (1981) (Unaccounted-for water is water that is acquired, goes into the distribution plant and never reaches a customer meter).

23 *See In Re: Pilot Project to Implement The International Water Association/American Water Works Association Water Audit Methodology*, Docket No. M-2008-2062697, Tentative Opinion and Order entered November 10, 2008; 2008 Pa. PUC LEXIS 839; and Tentative Opinion and Order entered November 10, 2011; 2011 Pa. PUC LEXIS 394; Secretarial Letter entered January 27, 2012 (stating that 2011 Tentative Order has become final and closing the docket).

Q. PLEASE COMMENT ON PWSA'S VIEW OF THE ADEQUACY OF ITS CURRENT PLAN TO ADDRESS NRW AND UNACCOUNTED-FOR WATER.

A. NRW is a complex issue. There are many steps that must be taken to identify, assess, and mitigate the sources of PWSA's NRW. For example, the following excerpt from the IWA/AWWA Water Balance Table shows (and highlights in grey) eight categories of NRW:

Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
		Billed Unmetered Consumption	
	Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water
		Unbilled Unmetered Consumption	
Water Losses	Apparent Losses	Unauthorized Consumption	
		Customer Metering Inaccuracies	
		Systematic Data Handling Errors	
	Real Losses	Leakage: Transmission and Distribution Mains	
		Leakage and Overflows at Storage Tanks	
		Leakage on Service Connections Up to the Point of Customer Metering	

PWSA has plans to address the categories of NRW:

Unbilled Metered Consumption	PWSA's plans to address the metering and issuance of bills to City (and others) can be found at: • LTIIP 2.3.7 (Unmetered and Flat Rate Properties); • Compliance Plan at 108-111.
Unbilled Unmetered Consumption	
Unauthorized Consumption	
Customer Metering Inaccuracies	PWSA's plans to address meter replacements can be found at: • LTIIP § 2.36 (Small Meter Changeout)
Systematic Data Handling Errors	

	• LTIIP § 2.3.8 (Large Meter Replacement Program) • Compliance Plan at 56-58, regarding compliance with 52 Pa.Code § 65.8
Leakage: Transmission and Distribution Mains Leakage and Overflows at Storage Tanks Leakage on Service Connections Up to the Point of Customer Metering	PWSA's plans to address leaks and to implement a comprehensive leak surveying program can be found at: • LTIIP § 2.3.1 to 2.3.3 (Small Diameter Main Replacement) • LTIIP § 2.3.4 (Large Diameter Main Replacement) • LTIIP § 2.35 (Hydrant and valve replacement) • Compliance Plan at 122 • Supplemental Compliance Plan at 11

Needless to say, the above-described plans will require more PWSA personnel. So, in FY 2018, PWSA planned and implemented a ramp up of personnel to significant increase in water operations/line maintenance repair work — with the intent of addressing NRW.

Q. WHEN DOES PWSA INTEND TO FILE ITS FIRST AWWA WATER AUDIT (DUE APRIL 30TH ANNUALLY) WITH THE COMMISSION AS REQUIRED BY THE NOVEMBER 10, 2011 FINAL IMPLEMENTATION ORDER AT DOCKET M-2008-2062697?

A. PWSA plans to file its first AWWA Water Audit in 2020.

Q. DO YOU BELIEVE THAT THIS TIMELINE IS ADEQUATE?

A. Yes.

Q. PLEASE DESCRIBE PWSA'S PLANNED IMPLEMENTATION OF A COMPREHENSIVE LEAK SURVEYING.

A. A plan for comprehensive leak surveying has been developed and will be implemented throughout 2019. By 2020, PWSA's comprehensive leak surveying program will be

consistent with AWWA standards and procedures. See Compliance Plan at 122. The Supplemental Compliance Plan addresses leak survey procedures as follows: PWSA started to install 210 Fixed base Permaloggers throughout the system and is in the process of purchasing new correlators to expedite the leak detection survey. The Permaloggers are used for monitoring the water lines. This technology measures sound waves and frequencies during the night and day. PWSA's goal is to deploy these loggers to right of ways, stream crossings, and areas of older infrastructure by the end of 2019. PWSA will also use the lift and shift method in difficult situations to monitor sites which exhibit leaks more effectively. PWSA is also evaluating advanced equipment such as tricorr corrilator, ground mics, and valve sounding survey tool to use in areas where there are no suitable valves or other locations to monitor sound via permaloggers. PWSA plans to consult with 540 technologies and LB Water vendors. Based upon logger deployment locations, approximately 19.5 square miles can be surveyed using the loggers that PWSA presently owns. Distribution crews will be made aware of this technology that we will deploy throughout our system.

Q. PLEASE EXPLAIN HOW DATA WILL BE COLLECTED AND UTILIZED.

A. Data will be collected for a period of up to 8 months per set up. Once collected, the data will be evaluated for leaks throughout the system. A total of 3 permalogger setups may be required to complete leak detection throughout the entire distribution system. Given the data analysis and follow up localized leak detection to isolate leaks, each section may require more than 12 months to complete. Based upon this timeline for each setup, we believe that the leak detection program can be completed in 3 to 4 years.

Q. PLEASE EXPLAIN HOW PWSA PLANS TO MANAGE ITS LEAK SURVEY PROGRAM?

A. PWSA hired a new Senior Manager – Leak Detection to assist with enhancing PWSA's program of data gathering and analysis as well as to provide additional staff training on newer leak detection methods. PWSA has a dedicated team of staff and equipment for this project. At present, we are proposing six staff in addition to the Senior Manager. Staff will be equipped with the permalogger equipment, computers, vehicles and other miscellaneous items for the program. In addition, PWSA has engaged a consultant to assist with a Water Study which includes assessment of service zone water use. We will utilize the metering systems in our high service pump stations and monitoring storage tank levels during the early morning hours to compare estimated water use by population served with the amount of water delivered to the system zone. This study will provide further focus on where water losses appear to be the greatest and focus our leak detection efforts to those areas.

Q. PLEASE DESCRIBE THE COSTS FOR IMPLEMENTATION OF A COMPREHENSIVE LEAK SURVEYING PROGRAM.

A. The annual costs for these staff are estimated to be approximately $650,000 to $800,000 per year. In addition, engineering technicians shall assist with the data analysis portion of the work, with a cost of less than $150,000 per year. The total program is expected to cost between $2.5 to $3 Million over a 3 to 4 year period. Additional expense could be incurred to engage a water leak specialist to assist with data analysis.

Q. PLEASE EXPLAIN WHY YOU BELIEVE THE TIMELINE AND COSTS FOR PWSA'S LEAK SURVEYING PROGRAM ARE REASONABLE.

A. PWSA recognizes the importance of addressing leaks and has developed a program and cost budget that takes into consideration all of the other priorities and projects that PWSA

is undertaking to provide safe, reliable service and to comply with various administrative requirements.

Q. HOW WILL PWSA'S LEAK DETECTION EFFORTS BE INCORPORATED INTO ITS CAPITAL IMPROVEMENT/INVESTMENT PLAN?

A. Leak detection is performed by the Operations division of PWSA and the division is undergoing a reorganization to accommodate new crews/assignments. The Operations division has a yearly line item in PWSA's budget for leak detection, and sets up the needed crew(s) to deal with leak detections. Leak Detection teams are considered an operations expense. Recently, the Operations division hired an experienced lead detection manager who brings new methods of detection to the crews. The Engineering and Construction division of PWSA supports the assessment and corrective actions performed by the Operations Department and Contractors to handle urgent issues. The Engineering and Construction division of PWSA intends to install distribution system metering to identify areas which exhibit high water losses to focus the lead detection efforts. Findings from these efforts will be inputted into PWSA's replacement prioritization model that will be developed as part of the Water Distribution System Master Plan.

I. <u>52 Pa. Code § 65.14 – Measurement</u>

Q. PLEASE DESCRIBE PWSA'S PLAN REGARDING MEASURING DEVICES AT EACH SOURCE OF SUPPLY.

A. Page 61 of PWSA's Compliance Plan indicates that PWSA does not have operational flow measuring devices installed at each source of supply (raw water into the water treatment plant and at the discharge of the two main pump stations which service the City). PWSA indicated that it has engaged an engineering consultant and several contractors to reestablish operability of the existing venturi meters at each source of

supply. An additional meter will be installed to measure the Fox Chapel Pump flows. The Compliance Plan stated that these meters should be operational by the end of 2018. They were not. The Consultants and PWSA Operations staff have an ongoing project to get the respective venturi devices operational at Ross, Aspinwall and Bruecken Pump Stations.

Q. PLEASE PROVIDE PWSA'S PERSPECTIVE IN RESPONSE TO QUESTION 34 ON EXHIBIT RAW/C-1, WHICH ASKS THE PARTIES DISCUSS WHETHER PWSA'S PLANS REGARDING MEASURING SATISFIES 52 PA.CODE § 65.14(B).

A. PWSA has one source of supply: the Allegheny River. PWSA has an East Intake and a West Intake on the Allegheny River. PWSA does not use ground or well water. PWSA's plan includes ensuring that there is measurement from the Ross Pump Station which is the only means of water withdrawal from the Allegheny River. That plan satisfies Section 65.14(a), which stipulates that each utility shall install a suitable measuring device at each source of supply, in order to create and maintain a record of water production rates. That data (once corrected for any known errors) will satisfy the part of Section 65.14(b) related to obtaining data on water production to the water treatment system. Additional metering after each filter will provide a basis to estimate the water use and losses from the water treatment processes. Losses result from flows released from the clarification system to waste, and the evapotranspiration losses from the open air sedimentation basis. Metering of the Filter Effluent and backwash rates will provide an estimate of the water used for maintaining the filter system through backwashing. PWSA is also considering methods to meter water flowing into the Highland 1 Reservoir. Water flows and losses from the Highland No. 1 reservoir so that water flows and losses from the Highland No. 1 reservoir and microfiltration plant (MFP) can be measured via

comparison of the Bruecken Pump Station raw water flows to the MFP output, which will be measured using existing venturi meters.

The remaining part of 65.14(b) regarding metered consumption will be satisfied by other parts of PWSA's metering plans. For example, PWSA's metering plans are discussed in Section 2.3.6 (Small Meter Changeout) and Section 2.3.8 (Large Meter Replacement Program) of the LTIIP. In addition, the additional meter at the Fox Chapel Pump Station will measure billed water sold/exported to the Fox Chapel Authority (under a bulk water sales agreement). Additional existing master meters document the flows delivered to key bulk customers of Aspinwall and Reserve Township.

Q. DOES THE COMPLIANCE PLAN ADEQUATELY ADDRESS THE RAW WATER METER ANALYSIS PRESENTED IN TABLE 4-3 OF THE PWSA 40 YEAR PLAN OF 2012?

A. Yes, it does. The Compliance Plan adequately addresses the "raw water" meter analysis in Table 4-3. Let me explain.

As summarized in the 40-Year Plan, a draft water audit was prepared around 2012 by HDR Engineering, Inc. The intent of the audit was to check the accuracy of the primary meters in the PWSA system and to quantify system-wide non-revenue water. The water audit was reviewed as the starting point for development of a comprehensive leak detection and repair program, which is summarized on Page 4-48 of the 40-Year Plan (Exhibit RAW/C-7).

Table 4-3 in the 40-Year Plan summarized the results of that draft water audit. Line 1 of Table 4-3 relates to raw water intake: Ross (Raw Water). Lines 2 to 20 of Table 4-3 relate to the distribution of treated drinking water from PWSA's Aspinwall Water Treatment Plant to various places in the system.

The Compliance Plan adequately addresses the "raw water" meter analysis in

Table 4-3 because Line 1 of Table 4-3 shows that the meters on PWSA's raw water intakes were not tested. As I discussed, the Compliance Plan proposes to restore operational measuring device(s) at each of PWSA's raw water intakes on the Allegheny River, plus the metering of the Ross Pump Station raw water flows. So, the Compliance Plan adequately addresses the raw water meter analysis in that Table. Lines 2 to 20 of Table 4-3 are deal with treated water, and are not part of any "raw water" analysis.

J. System Reliability, Emergencies, Service Disruptions

Q. PLEASE EXPLAIN WHETHER PWSA'S NOTIFICATION STANDARD OPERATING PROCEDURES ARE CONSISTENT WITH 52 PA. CODE §§ 65.2, 65.11, AND 69.1603?

A. Yes. PWSA recently updated its Investigation Policy and Procedures to ensure compliance with 52 Pa. Code § 65.2. Per the regulations, a "reportable accident" involving a fatality shall be made immediately after PWSA is made aware of the accident. For reportable accidents not involving a fatality, a report by telephone shall be made within 24 hours after PWSA is made aware of the accident. Written reports using Form UCTA-8 (redacted if necessary to not compromise or hinder an active criminal investigation) will be made within 30 days of the occurrence of reportable accident. PWSA's Director of Operations is responsible for ensuring that telephone and written reports are completed as required. PWSA will also provide a written report on Form UCTA-8 within 30 days of the occurrence of a reportable accident. If PWSA is experiencing a short term supply shortage and may either request general conservation of inside water uses or impose mandatory conservation measures, then PWSA will provide notice of its plans to all customers or will provide notice/information by radio, television, newspaper advertisement. Finally, notice will be made to Commission personnel as soon as possible upon PWSA becoming aware of an unscheduled service interruption.

Q. PLEASE PROVIDE AN OVERVIEW OF PWSA'S CURRENT EMERGENCY RESPONSE PLAN.

A. PWSA's current Emergency Response Plan ("ERP") was most recently revised and updated in 2016. In 2018, PWSA assembled a Planning Committee tasked with revising the current version of the ERP. The Planning Committee includes representatives from PWSA's Communications, Engineering, Operations and Maintenance, and Customer Service. PWSA's final ERP will incorporate the various Commission requirements related to system reliability and reporting including those 52 Pa. Code §§ 69.1601-69.1603. PWSA anticipates that its revised ERP will be completed in the fall of 2019.

PWSA's current working draft ERP includes provisions related to: 1) PWSA organization and key contacts; 2) communication procedures and contact information; 3) means of communication; 4) summary description of the system; 5) assessment of available resources; and 6) corrective actions for probably emergencies.

Q. IDENTIFY EACH STEP OF THE INFORMAL PROCESS THAT PWSA USES FOR NOTIFYING THE COMMISSION OF UNSCHEDULED SERVICE INTERRUPTIONS THAT AFFECT AT LEAST 2,500 CUSTOMERS OR 5% OF THE UTILITY'S TOTAL CUSTOMER BASE (WHICHEVER IS SMALLER) AS REFERENCED ON P. 70 OF PWSA'S COMPLIANCE PLAN FILED ON SEPTEMBER 28, 2018.

A. PWSA will establish an open communication channel with the designated representatives of the Commission to notify of unscheduled service interruptions that affect at least 2500 customers. Once the service interruption has been identified and PWSA's Operations and Maintenance (OPS) crews have established the boundaries or customers affected by the unscheduled service interruption, then the Commission will be contacted either through the Customer Service and/or Communications departments, if the interruption is at least 2500 customers. PWSA is in the process of revising its current flow chart of

Communication protocols to include the Commission and expects to have this completed by the end of the first quarter 2019.

Q. HOW ARE CUSTOMERS NOTIFIED OF UNSCHEDULED SERVICE INTERRUPTIONS?

A. Field crews notify the Public Affairs department which will send out automated telephone calls to the affected customers. Foreman on-site may also notify affected persons directly in person if possible. Emails and social media notifications are also issued if the outage is larger than 40 homes or a major traffic thru-way is blocked due to work. In general, communication with the public in these types of situations are my or my designate. PWSA's Communications Department coordinates the appropriate response to the public on behalf of PWSA through the normal channels, including newspaper, radio and television transmissions, direct emails, phone calls, and social media.

Q. IS PWSA ALREADY CURRENTLY REQUIRED TO PROVIDE NOTICE TO DEP?

A. Yes. DEP requires notification within one hour of two consecutive low pressure (below 20 psi) alarms at a single site (24 pressure alarm devices are installed throughout the distribution system, with an additional 40 to be installed in the next year). Therefore, PWSA's Compliance Team has a nominal requirement for one hour notification for all such pressure alarms. The additional responsibilities to notify the Commission of any system failure can be incorporated into the Compliance Team reporting protocols.

Q. DOES PWSA'S EMERGENCY MANAGEMENT PLAN FOLLOW THE NATIONAL INCIDENT MANAGEMENT SYSTEM'S PUBLIC INFORMATION SYSTEM ACCORDING TO 52 PA. CODE § 69.1602?

A. Not at this point. In developing its ERP, PWSA followed the guidelines established by DEP. PWSA did not become aware of the NIMS format until the 2016 revision of its

ERP was nearly completed. Because so much of the information required by the NIMS is addressed in the context of the 2016 revision, PWSA elected to maintain the PADEP format at that time. As part of the current revision of its ERP, PWSA is striving to incorporate all facets of the NIMS and will work with the Allegheny County Emergency Management Division and the Department of Homeland Security to implement those revisions. PWSA anticipates that the revised ERP will be completed in the fall of 2019.

Q. PLEASE DISCUSS WHETHER PWSA SHOULD AGGRESSIVELY PURSUE INTERCONNECTIONS WITH OTHER REGIONAL WATER SUPPLIERS TO ENHANCE SYSTEM RESILIENCY.

A. PWSA does not believe that pursuing such a strategy would be cost efficient or materially improve its reliability. None of the adjacent suppliers have sufficient water to serve any significant water deficits that PWSA may experience. PWSA has interconnection agreements, but those agreement are, generally speaking, for supply by PWSA to the other supplier. PWSA does not anticipate that those interconnections could yield sufficient water from any of the other suppliers to PWSA to address a PWSA deficit situation. PWSA has, however, used those interconnections to obtain limited amounts of water from other suppliers for small parts of PWSA's service area that were experiencing a system failure, or to assist with nominal shutdowns to repair mains, install hydrants and/or valves.

V. LEAD REMEDIATION

A. Orthophosphate; Corrosion Control Project

Q. PLEASE DESCRIBE PWSA'S INTRODUCTION OF ORTHOPHOSPHATE INTO ITS WATER TREATMENT TO DATE.

A. DEP approved PWSA's plan to utilize orthophosphate as corrosion control treatment on April 27, 2018. A copy of the DEP approval letter is attached as Exhibit RAW/C-21.

Adding orthophosphate to treated drinking water requires installing additional equipment and facilities that must also be approved by the PA DEP. DEP approved PWSA's use of Orthophosphate as Optimal Corrosion Control Treatment on April 27, 2018. On May 10, 2018, PWSA submitted an application to the PA DEP for approval to proceed with construction of these items.[24] That approval (i.e., construction permit) was granted on September 24, 2018, and the construction is in progress. A copy of the DEP approval letter is attached as Exhibit RAW/C-22. Recently, PWSA obtained the final permits needed from Pittsburgh municipal agencies.

Once construction is complete, the PA DEP will need to issue an operations permits before PWSA can begin adding orthophosphate. While PWSA initially expected that it would introduce orthophosphate into its system in Fall/Winter 2018, it experienced delays in obtaining municipal permits. PWSA currently plans to begin to introduce orthophosphate into its system on March 15, 2019. The initial two injection points will be the Highland Reservoir 2 and Lanpher Reservoir Service Areas followed by the Highland 1 Reservoir Service Area.

Q. PLEASE DESCRIBE PWSA'S PLANS TO ADD SEVERAL ORTHOPHOSPHATE INJECTION POINTS AND EQUIPMENT FOR CORROSION CONTROL AS REQUESTED BY PLEASE REFER TO QUESTIONS 7 AND 7.1 ON EXHIBIT RAW/C-1.

A. It is expected that the introduction of orthophosphate into the water treatment process will result in reduced lead levels to below action levels at homes with lead service lines. If facilities become operational in March 2019, PWSA anticipates that the treatment will reduce lead levels beginning in June 2019.

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[24] 48 Pa. Bull. 3067, 3101 (May 26, 2018).

Q. PLEASE IDENTIFY THE DESIGN ENGINEER AND THE ESTIMATED COST, FUNDING SOURCE, TIMELINE AND MILESTONE DATES FOR THE ADDITION OF ORTHOPHOSPHATE INJECTION POINTS AND EQUIPMENT FOR CORROSION CONTROL.

A. Application rates of orthophosphate at 1-2 parts per million are acceptable to DEP. It is expected that PWSA will be injecting orthophosphate at the Highland Reservoir 2 and Lanpher Reservoir Service Areas on March 15, 2019. PWSA will subsequently introduce orthophosphate at the Highland 1 Reservoir Service Area. This chemical injection schedule is subject to final approval of the PA DEP.

Professional Services:

- PWSA Program Coordination (Embedded Project Manager): Hatch Associates Consultants: $160,800.00 (Task Order CE27-151)
- Program Management Cost: Mott MacDonald: $17,649.50 (Task Orders MM23-120 and -121)
- Construction Management/Coordination/Field Inspection: Hatch Associates Consultants: $299,900.00 (Hatch - CE27-165)
- Pilot Plant and Chemical Treatment Plan (Corrosion Control Study, Lead Pipe Loop Study, and Permitting): Mott MacDonald: $744,434.50 (Task Order MM23-121)
- Orthophosphate Storage and Feed Facilities Design Engineer:
  - Preliminary Design: Arcadis US: $31,543.00
  - Full Design (30% to Final): Mott MacDonald: $367,916.00 (Task Order MM-120)
  - Specialty Consulting/Services: Subtotal $38,477.72: Consisting of:
    - PFS (Differential Pressure Monitors): $30,740.00
    - CDW Government: $3,244.68
    - Hach: $4,493.04
- Construction Costs:
  - Construction: Total Equipment Company: $5,182,689.00: Consisting of:
    - Long Lead Equipment Contract: $466,415.00
    - Construction Contract: $3,714,622.00
    - Change Orders: $1,001,652.00
  - Other Construction Costs: PFS: $22,810.00

Total Professional Services and Construction Costs: $6,866,219.72

- Interim Operations Date: March 31, 2019
- Construction Completion: May 15, 2019

B. **Lead Service Line Replacement Project**

Q. PLEASE DESCRIBE PWSA'S LEAD SERVICE LINE REPLACEMENT PROJECT AS REQUESTED BY QUESTIONS 7 AND 7.2 ON EXHIBIT RAW/C-1.

A. PWSA's lead service line replacement project is discussed in the Compliance Plan and the Compliance Plan Supplement. *See* Compliance Plan at 119-121; Compliance Plan Supplement at 4-8. The lead line replacement program was launched under PWSA's construction budget allocation to address the Consent Order and Agreement ("COA") with PA DEP dated November 17, 2017.

In January 2018, PWSA adopted a lead service line policy which mandates and pays for replacement of both the public and privately owned portions of those lines, prioritizing properties where pregnant women and young children under six years of age live. Consistent with that policy, PWSA expects, in 2019 through mid-2020, to replace approximately 3,400 public-side lead service lines and 2,800 private-side lead service lines in several neighborhoods, including Morningside, Homewood, Perry, Mt. Washington, Southside, Northside and Greenfield. That work will be funded by a loan and grant by PENNVEST.

Q. HOW DID PWSA DETERMINE TO LIMIT ITS LEAD LINE REPLACEMENT POLICY TO SINGLE-FAMILY RESIDENTIAL PROPERTIES WITH SERVICE LINES OF 1-INCH OR LESS?

A. PWSA's lead service line policy targets single family residential properties. Those properties are more likely to have a lead service line, since single family residential properties tend to have a service line with a maximum diameter of 1-inch and multi-family properties tend to have service lines with diameters of greater than 1 inch. The typical service line size is a key factor, since historically it was rare for lines over 1-inch

to be made of lead. Historically, lead lines smaller than 1-inch were cheaper than other options (iron or galvanized). However, lead lines over 1-inch tended to be more expensive than other options. So, PWSA targeted replacements at single family residential properties with service lines of 1-inch or less. Where lead service lines with diameters larger than 1 inch at existing residential properties, these lines are addressed typically by replacing the service lines with standard 1 inch residential lines, including installation of multiple individual lines if more than one housing unit is served by the existing service line.

Q. PLEASE DESCRIBE YOUR UNDERSTANDING OF 66 PA.C.S. § 1501.

A. Section 1501 of the Public Utility Code obligates all regulated utilities to provide safe and reasonable service and to make repairs or improvements that are necessary for the safety of its customers. 66 Pa. C.S. § 1501.

Q. IS PWSA'S POLICY OF LIMITING LEAD LINE REPLACEMENTS TO SINGLE-FAMILY RESIDENTIAL PROPERTIES WITH SERVICES LINES OF 1-INCH OR LESS CONSISTENT WITH 66 PA.C.S. § 1501?

A. Yes, as stated in 66 Pa.C.S. § 1501, "every public utility may have reasonable rules and regulations governing the conditions under which it shall be required to render service." PWSA's current Water Tariff, approved by the Commission, indicates in Section B.12, "All Residential service lines larger than 1-inch in diameter and all Non-Residential service lines, regardless of diameter, are the responsibility of the property owner, including the section from the Curb Stop, the Curb Box, and that portion of the Water Service Line running from the Curb Stop to the Water Main." Therefore, PWSA's policy of limiting lead line replacements to Residential service lines 1-inch and less in diameter is reasonable.

Q. IDENTIFY THE DESIGN ENGINEER AND THE ESTIMATED COST, FUNDING SOURCE, TIMELINE AND MILESTONE DATES FOR PWSA'S LEAD LINE REPLACEMENT PROJECT.

A. As explained in the CP and referenced above, "In 2017, PWSA entered into a Consent Order and Agreement ("COA") with PA DEP to resolve regulatory issues related to lead service line replacements, corrosion control treatment and other related matters. The COA sets amended deadlines for performing 'public side' lead service line replacements, completing a lead service line system inventory, finishing a corrosion control treatment study, and implementing the optimized corrosion control water treatment." CP at 119. The details, including the compliance timeline, are in the DEP Consent Order and Agreement ("COA").

The CP indicates that PA DEP expects PWSA to inventory all residential service line connections and identify those that contain lead by December 31, 2020. To date, PWSA has used its Curb Box Inspection program to undertake this inventory. Approximately 17,500 locations have been inventoried and processed through PWSA's quality assurance and quality control process. PWSA has identified 1,900 lead lines through this inventory process. PWSA is in the process of evaluating various methods to complete the inventory of its residential service line connections.

In 2018, PWSA replaced 2,050 public side lead service lines and 1,324 private side service lines. The summary of the firms, responsibilities and costs for the 2018 project are listed below:

Scope of Work	Firm(s) Supplying Service	Actual Billed Costs	Completion Date
Design Services	PWSA		February 2018
Program Management	East Woods Consultants, LLC	$347,386.35	December 31, 2019

Staff Supplements	Mott MacDonald	$1,550,778.87	December 31, 2019
Staff Supplements	AECOM	$114,073.07	October 1, 2018
Staff Supplements	Glen Stephens, Inc	$80,849.60	December 31, 2019
Internal Inspections	Glen Stephens, Inc	$90,617.83	July 2018
Field Liaisons	PWSA	$175,027.86	January 2019
Construction Management and Inspection	AECOM	$743,992.10	April 2019
	Glen Stephens, Inc	$359,638.08	April 2019
	JMT	$163,673.55	December 31, 2018
	HATCH	$150,222.69	April 2019
Construction	A. Merante Construction	$2,725,650.9	February 28, 2019
	W. A. Petrakis	$4,126,964.61	February 28, 2019
	F. J. Zottola	$3,197,119.15	February 28, 2019
	Independent Enterprises, Inc.	$3,299,144.24	February 28, 2019
	A. Folino	$416,041.99	September 30, 2018
Curb Box Inspection	Michael Baker, Inc.		
Lead Help	PWSA	$118,090.05	January 2019

Note that these costs are associated with the 2018 Neighborhood based contracts only, and do not include: (1) the 2017 Program; (2) Individual Lead Service Line Replacement (ILSLR) Contracts; (3) Filters and Pitchers; and (4) Other Miscellaneous Costs not covered by the consulting or construction firms (i.e. phones, computers, etc.).

The details for the 2019-2020 lead service line replacement program are contained in the application materials submitted to PENNVEST are provided in Exhibit RAW/C-23. PWSA's goal is to replace the public side of the residential lead service lines in its system by 2026 through its 2020-2026 small diameter water main replacement program. CP at 120. However, if the PWSA Policy For Lead Service Line Replacement

remains unchanged, PWSA will not leave a partial lead line at a residence if the Public Side Lead Line is replaced. For PWSA's Small Diameter Water Main Replacement Program, regardless of the material of the public line, PWSA will replace private side lead lines (with the requisite customer consent) since PWSA would be disturbing the line as part of the main replacement activities.

Q. PLEASE DESCRIBE PWSA'S DEDICATED FUNDING FOR PRIVATE LEAD LINE REPLACEMENTS FOR CUSTOMER ASSISTANCE PROGRAM CUSTOMERS AND WHETHER SUCH FUNDING COMPLIES WITH 66 PA. C.S. § 1304.

A. A component of PWSA's Private Lead Line Replacement policy is a Community Environmental Project ("CEP"). Funding for the CEP is separate and distinct from PWSA's construction budget. The CEP provides private-side lead line replacements for customers who are at or below 250% of the Federal Poverty Level. CP at 76.

Under the November 2017 COA, PA DEP allowed PWSA to apply $1.8 million of what would have otherwise been a civil penalty to a private lead line replacement program for low income households. The PA DEP specified certain requirements for the CEP in COA.

Prior to the award of additional funds by PENNVEST, PWSA's current financial status prevented it from committing to cover costs for private-side lead service line replacements after December 31, 2018, except for the customers served by the CEP. PWSA's CEP complies with Section 1304 as it is a reasonable and just program to advance the replacement of private-side line replacements for customers who may not be able to afford replacement of their private-side lead service lines. PWSA is trying to use as much of the $1.8 million in funds for the CEP as it possibly can, as funds that have not

been used within three years from the execution of the Consent Order and Agreement must be paid to PA DEP as a civil penalty.

Q. IS PWSA'S COMMUNITY ENVIRONMENTAL PROJECT REASONABLE CONSIDERING THE RECENT OCTOBER 17, 2018 PENNVEST LOAN AND GRANT AWARDED TO PWSA.

A. Yes. PWSA's Community Environmental Project ("CEP") is reasonable as it provides private-side lead service line replacements to customers who are at or below 250% of the Federal Poverty Level, regardless of whether their lines are located in the neighborhoods that will be covered by the PENNVEST loan and grant, or those locations at which the public service line is not lead. While the PENNVEST funds are to be spent on lead service line replacements in low-income neighborhoods, the funds are not directed to only low-income customers. The CEP advances private-side line replacements for low-income customers who may not be able to afford to replace their lead service line. This project is reasonable, especially in light of the use or lose nature of the funds.

Q. WHAT ARE PWSA'S PLANS FOR THE FUNDING OF THE LEAD SERVICE LINE REPLACEMENT PROGRAM BEYOND 2019?

A. The loan and grant from PENNVEST will provide funding for 2019 through part of 2020. No other definitive sources of funding have been identified beyond this loan and grant. The implementation of our Small Diameter Water Main Replacement Program will address all remaining Public Side Lead Service Lines, as each public line will be replaced as each water main is replaced.

Q. PLEASE DESCRIBE THE PENNVEST LOAN AND GRANT AWARDED TO PWSA IN OCTOBER 2018.

A. On October 17, 2018, PWSA was awarded a $35,441,231 loan and a $13,687,173 grant from PENNVEST to replace residential public lead connections and private side lead service lines in the City. With these funds, PWSA expects to replace approximately

3,400 public-side lead service lines and 2,800 private-side lead service lines in 2019 and 2020. Contractor bids for the upcoming lead service line work showed a reduction in the individual service line replacement costs. As a result, PWSA expects to increase the total Lead Service Lines replaced to: 4,400 public side lead service lines and 3,400 private side service line replacements. The PENNVEST finance closing is scheduled for March 2019. The Commission registered an Abbreviated Securities Certificate for this transaction on February 5, 2019 (S-2019-3007162).

Q. PLEASE DETAIL ANY CHANGES TO THE PENNVEST LOAN AND GRANT AWARDED TO PWSA.

A. In early January 2019, PWSA and PENNVEST agreed to reduce the length of the PENNVEST loan from a 30-year loan to a 25-year loan. As a result, the load repayment will expire at the same date of the extensions of the PWSA leasing responsibilities as authorized previously by City Council. That agreement was reached before the Abbreviated Securities Certificate was filed with the Commission.

PENNVEST also agreed to a change in the administration of the grant and loan. Initially, PENNVEST would have required PWSA to identify all replacement locations prior to closing on the grant and loan which would have necessitated PWSA having all customer agreements in-hand well in advance of performing the replacements. Due to the various challenges associated with obtaining customer agreements, PENNVEST has agreed to allow PWSA to collect customer agreements after closing on the grant and loan so long as the replacement locations and customer agreements are provided to PENNVEST prior to submitting an application for payment associated with those locations. This change in the administration of the grant and loan provides PWSA

additional time to collect customer agreements to perform private-side lead line replacements.

Q. WHAT IS PWSA'S POLICY FOR PRIVATE LEAD LINE REPLACEMENT AND PUBLIC LEAD LINE REPLACEMENT?

A. PWSA's lead line replacement efforts must be distinguished between the public side of the service line (the portion of the line from the main to the curbbox) and the private side of the line (the portion from the curb box to the building meter). PWSA's lead service line replacement program is funded at an accelerated rate in 2019 up to mid-2020.

With respect to the public side after 2019/2020, PWSA intends to replace public side lead service lines as part of its small diameter water main (SDWM) program. All public side service lines, up to and including the curb stop, will be replaced when the SDWM is replaced.

With respect to the private side, PWSA is removing lead service lines on the private portion of customers' properties pursuant to an interim program that will last through at least 2019. With the recent award of PENNVEST funding to PWSA, PWSA plans to replace an additional 2,800 to 3,400 private-side lead service lines in the City in 2019 and into 2020.

PWSA is not under any regulatory obligation to replace private side customer service lines. PWSA has not made a determination as to what its plans will be with regards to replacement of private side lead service lines post-2019/2020. The Board has not issued a policy decision on this matter. PWSA anticipates that it will formulate its plan for lead service line replacements in 2020 by May 2019. CP Supplement at 8.

If PWSA's Board makes a policy determination to perform private line replacements post-2019 that does not mean that all private side lead lines would be

replaced. As PWSA only owns the public-side service lines, PWSA cannot require a customer to replace a private-side lead service line. Some PWSA customers have refused to consent to replacement of their private side lead lines or have failed to return the required consent agreement in a timely manner, despite prompting to do so.

Q. IN LIGHT OF THE PENNVEST LOAN AND GRANT, IS PWSA'S PRIVATE LEAD LINE REPLACEMENT PLAN REASONABLE?

Yes. PWSA's private lead line replacement plan is reasonable in light of the PENNVEST loan and grant. PWSA plans to replace an additional 2,800 to 3,400 private-side lead service lines in the City in 2019 and into 2020. PWSA's Board has not yet made a determination as to what its plans will be with regards to replacement of private-side lead service lines post the 2019/2020 PENNVEST funded lead service line replacement program. Due to PWSA's limited financial resources and the various other critical efforts underway to reduce lead levels in the water supply (including the application of orthophosphate), PWSA's current plans and continued evaluation of future private lead line replacements is reasonable.

Q. DOES PWSA'S POLICY FOR REPLACING CUSTOMER OWNED LEAD SERVICE LINES COMPLY WITH 66 PA. C.S. § 1304?

A. Yes. Rates for any service provided under the Public Utility Code must be just and reasonable and, pursuant to Section 1304 of the Code, may not establish any unreasonable preference or prejudice to any customer. 66 Pa.C.S. §§ 102, 1301, 1304. PWSA's policy for replacing customer owned private side lead service lines complies with Section 1304 as it is a reasonable and just policy to advance the replacement of lead service lines based on PWSA's plans to expedite lead service line replacements, its planned introduction of orthophosphate into the system, and its financial constraints.

Moreover, as proven in numerous City's worldwide, orthophosphate treatment should all but eliminate lead corrosion in service lines.

Q. PLEASE EXPLAIN THE RELATIONSHIP BETWEEN THE REPLACEMENT PROGRAM FOR CUSTOMER-OWNED LEAD SERVICE LINES AND THE POTENTIAL IMPLEMENTATION OF A DSIC MECHANISM.

A. PWSA is reviewing the advisability of proposing a DSIC to recover costs of construction for both lead-replacement and non-lead replacement as part of the small diameter water main replacement program. PWSA expects to complete its review in the next several months to establish how we would fund our program.

Q. PLEASE DESCRIBE PWSA'S COMMUNITY LEAD RESPONSE ADVISORY COMMITTEE.

A. Pursuant to the Rate Case Settlement, PWSA formed a Community Lead Response Advisory Committee ("CLRAC") to provide consultation and feedback on PWSA's lead service line replacement program and lead remediation efforts in 2019 and 2020. The CLRAC consists of interested parties from the rate case and representatives from local community groups, local government and other interested parties. The initial term of the CLRAC is two years but it may be extended at PWSA's discretion. At the first CLRAC meeting on January 8, 2019, PWSA presented a Community Outreach and Communication Plan for the 2019 LSLR Program for CLRAC comment and input. PWSA also reported at the initial CLRAC meeting its efforts to track customers' reasons for rejecting service line replacements and associated data. At the second CLRAC meeting held on February 6, 2019, PWSA provided an update on its lead service line replacement program and lead remediation efforts. PWSA also addressed prioritization of 2019 lead service line replacements.

Q. DOES PWSA PLAN TO CONTINUE THE COMMUNITY LEAD RESPONSE ADVISORY COMMITTEE BEYOND 2020?

A. Once the two year term for the CLRAC is closer to expiring, PWSA will carefully evaluate whether to continue the CLRAC. The evaluation of whether to continue the CLRAC will include an assessment of the effectiveness of the introduction of orthophosphate in to the water treatment process and the current state of the lead service line replacement program.

Q. HOW DOES PWSA MAKE HISTORICAL SERVICE LINE RECORDS AVAILABLE FOR PUBLIC VIEWING?

A. Yes. PWSA provides a map on its website which makes a determination of material type based on available data.

Q. DOES PWSA PLAN TO CONTINUE TO MAKE ALL HISTORICAL SERVICE LINE RECORDS AVAILABLE FOR PUBLIC VIEWING AFTER 2019?

A. Yes. PWSA plans to continue to make all historical service line records available for public viewing beyond 2019.

Q. WHAT IS PWSA'S CURRENT PROCEDURE FOR NOTIFYING A RESIDENT AND PROPERTY OWNER OF THE RESULTS OF A CURB BOX INSPECTION?

A. PWSA is currently making best efforts to send a letter notifying the resident and property owner of the results of a curb box inspection conducted at the relevant address within 90 days of the completion of the inspection, but not later than 120 days.

Q. DOES PWSA PLAN TO CONTINUE NOTIFYING A RESIDENT AND PROPERTY OWNER OF THE RESULTS OF A CURB BOX INSPECTION BEYOND 2019?

A. Yes. PWSA plans to continue notifying a resident and property owner regarding curb box inspections conducted at the relevant address within 90 days of the completion of the inspection, but not later than 120 days.

Q. DOES PWSA PLAN TO CONTINUE TO MAKE THE LOCATIONS OF ALL SERVICE LINE REPLACEMENTS CONDUCTED BY PWSA TO DATE AND PLANNED FOR THE WORK ORDERS PUBLICLY AVAILABLE ON ITS WEBSITE?

A. Yes. Beyond 2019, PWSA plans to continue making the locations of all service line replacements conducted by PWSA to date and planned for the work orders publicly available on its website. A map demonstrating the 2019 work orders is attached as Exhibit RAW/C-24.

Q. PLEASE PROVIDE UPDATED INFORMATION REGARDING CURRENT PER-LINE COSTS FOR LEAD SERVICE LINE REPLACEMENTS.

A. The construction-only costs for the 2018 work order areas are between approximately $4,500 and $5,000 for the public side and $7,500 and $8,000 for the private side, with an average cost of around $12,300 for both a public and private side lead line replacement at the same location. Final costs for the 2018 program are expected to be available in March 2019.

Q. WHAT ARE PWSA'S PLANS TO REDUCE LEAD SERVICE LINE REPLACEMENT COSTS FOR 2019 AND BEYOND?

A. PWSA undertook significant efforts to review its 2018 lead service line replacement program and develop strategies for lowering the costs in 2019. PWSA's 2019 contractor bid costs came in significantly lower than in 2018, resulting in an anticipated public and private side replacement cost of around $9,500. PWSA will continue to review per line costs and evaluate methods to lower those costs beyond 2019.

Q. WHAT WILL PWSA'S POLICY ON PRE-REPLACEMENT AND POST-REPLACEMENT FILTERS BE AFTER 2019?

A. PWSA intends to consult with the CLRAC to evaluate the provision of pre-replacement and post-replacement filters in 2019 and 2020. Currently, PA DEP only requires that filters be provided in the event of a partial replacement. PWSA is currently providing

filters for full line and partial replacements as lead levels can temporarily increase for full line replacements as well as partial replacements. PWSA's review and analysis of its current policy and water sample data, as well as any regulatory requirements, will guide its plans for the provision of filters beyond 2020.

Q. WHAT IS PWSA'S PRIORITIZATION PROCESS FOR ITS SMALL DIAMETER WATER MAIN PROGRAM?

A. The prioritization model for the 2019 small diameter water main program is described in Section 2.3.2. of the LTIIP. The 2020 small diameter water main program piggybacks on the 2019 lead service line replacement program and will replace water mains within the 2019 lead service line replacement areas that are undersized or known to be in poor condition. The prioritization model to be used for the 2021 small diameter water main program will be developed in 2020. PWSA plans to undertake a 2-year upgrade to its Geographic Information System (GIS) to include main break, main age and main material to provide a more robust prioritization model.

Q. HAS PWSA SELECTED THE SMALL DIAMETER WATER MAINS IT PLANS TO REPLACE IN 2020?

A. Yes. In 2020, PWSA plans to replace the small diameter water mains that are identified in Exhibit RAW/C-25.

Q. FOR LEAD SERVICE LINE REPLACEMENTS THAT TAKE PLACE AFTER 2019, UNDER WHAT CIRCUMSTANCES WILL PWSA CONDUCT PARTIAL REPLACEMENTS OF LEAD SERVICE LINES?

PWSA has not made a determination as to what its plans will be with regards to replacement of private side lead service lines beyond 2019. The Board has not issued a policy decision on partial replacements of lead service lines beyond 2019. As noted above, if PWSA's Board makes a policy determination to perform private line replacements post-2019 that does not mean that all private side lead lines would be

replaced. As PWSA only owns the public-side service lines, PWSA cannot require a customer to replace a private-side lead service line.

Q. DOES PWSA INTEND TO CONTINUE A LEAD HELP DESK TEAM AND FIELD LIAISONS FOR 2020 THROUGH 2026?

A. Yes. PWSA intends to continue a Lead Help Desk Team and Field Liaisons for 2020 through 2026.

Q. FOR LEAD SERVICE LINE REPLACEMENTS THAT TAKE PLACE AFTER 2019, DOES PWSA HAVE PLANS REGARDING WHETHER AND HOW TO SEEK AUTHORIZATION FROM THE CITY OF PITTSBURGH TO COMPEL PRIVATE-SIDE LEAD SERVICE LINE REPLACEMENTS WHEN A PROPERTY OWNER WHO DOES NOT RESIDE AT THE PROPERTY DECLINES A FREE PRIVATE-SIDE LEAD SERVICE LINE REPLACEMENT?

A. No. PWSA raised the issue of whether and how to seek authorization from the City of Pittsburgh to compel private-side lead service line replacements when a property owner who does not reside at the property declines a free private-side lead service line replacement at its initial CLRAC meeting. PWSA intends to continue to consult with the CLRAC regarding this matter but has no discrete plans regarding this issue as it applies to replacements made after 2019.

Q. HAS PWSA CONSULTED WITH THE CLRAC REGARDING WHETHER TO ASK THE CITY OF PITTSBURGH TO ESTABLISH A PROCESS THROUGH WHICH PARTIAL LEAD SERVICE LINE REPLACEMENTS CONDUCTED BY PWSA ARE DOCUMENTED IN THE PROPERTY RECORD FOR THE RELEVANT ADDRESS?

A. Yes. PWSA has consulted and will continue to consult with the CLRAC regarding whether to ask the City of Pittsburgh to establish a process through which partial lead service line replacements conducted by PWSA pursuant to its 2019 lead service line replacement program are documented in the property record for the relevant address. PWSA has not made any determination with regard to whether to ask the City of

Pittsburgh to establish such a process for partial lead service line replacements that are conducted after 2019.

VI. TESTIMONY IN SUPPORT OF LTIIP

Q. WHY DID PWSA FILE A LONG-TERM INFRASTRUCTURE IMPROVEMENT PLAN ("LTIIP") WITH THE COMMISSION?

A. Section 3204(b) of the Public Utility Code directed PWSA to file an LTIIP with the Commission[25] no later than Friday, September 28, 2018.[26] This was done,[27] although PWSA is not requesting approval for a Distribution System Improvement Charge ("DSIC") at this time.[28]

Q. PLEASE OUTLINE WHAT PROCEDURAL ACTIONS THAT FOLLOWED THE FILING OF PWSA'S LTIIP.

A. PWSA's LTIIP was docketed at P-2018-3005037 and P-2018-3005039. By Secretarial Letter dated January 3, 2019, the Commission noted that it was extending its review prior for the LTIIP petition until February 28, 2019. On January 4, 2019, the Commission served TUS Data Requests Set 1. PWSA's Motion to Consolidate the LTIIP with this proceeding that was filed on December 14, 2018 continues to remain pending. On February 5, 2019, the Commission assigned PWSA's LTIIP to the OALJ.

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25 *See* 66 Pa.C.S. § 3204(b), which states, in part, that PWSA "shall file a compliance plan with the commission which shall include provisions to bring an authority's existing information technology, accounting, billing, collection and other operating systems and procedures into compliance with the requirements applicable to jurisdictional water and wastewater utilities under this title and applicable rules, regulations and orders of the commission. The compliance plan shall also include a long-term infrastructure improvement plan in accordance with Subchapter B of Chapter 13 (relating to distribution systems.").

26 *Implementation of Chapter 32 of the Public Utility Code; RE: Pittsburgh Water And Sewer Authority*, Docket Nos. M-2018-2640802 and M-2018-2640803, Final Implementation Order entered March 15, 2018 ("FIO") at 36. See also Implementation of Chapter 32 of the Public Utility Code; RE: Pittsburgh Water And Sewer Authority, Docket Nos. M-2018-2640802 and M-2018-2640803, Tentative Implementation Order entered January 18, 2018 ("TIO"), at 18.

27 PWSA's LTIIP was docketed at P-2018-3005037 (water) and P-2018-3005039 (wastewater).

28 *See* PWSA's Compliance Plan at 98-103.

Q. HAS PWSA PREPARED ANSWERS TO THE TUS DATA REQUEST SET I?

A. Yes we have and they are included with this testimony as Exhibit RAW/C-2. I am sponsoring the responses and state that the fact set forth therein are true and correct to the best of my knowledge, information and believe and that I expect to be able to prove same at a hearing held in this matter.

Q. WHAT IS THE PURPOSE OF INCLUDING PWSA'S RESPONSES WITH THIS TESTIMONY?

A. I am including our responses with this testimony as further support for PWSA's LTIIP in addition to the relevant information I discussed previously as well as the LTIIP specific information I will be discussing next.

Q. PLEASE DESCRIBE THE LTIIP FILED BY PWSA.

A. This is the initial LTIIP filing by PWSA. The LTIIP outlines how PWSA plans to implement a program to rehabilitate, improve, and replace aging infrastructure at an accelerated pace for the five-year period from January 1, 2019 to December 31, 2023.

The LTIIP includes information on how PWSA intends to replace and/or upgrade targeted eligible property to improve system reliability and safety, and it includes metrics that PWSA uses to track and evaluate the effectiveness of infrastructure improvements. The LTIIP also provides the rationale used to select and target eligible programs and property for LTIIP consideration, and a projection of annual capital expenses to ensure that the LTIIP is cost-effective.

Q. WHAT IS THE PROFILE OF PWSA'S DISTRIBUTION SYSTEM?

A. The water distribution system includes two finished water pump stations, eight distribution pump stations, three covered finished water reservoirs, one uncovered source water reservoir, and nine distribution storage tanks. The elevations of these assets are

shown in Exhibit RAW/C-26. The LTIIP provides a comprehensive description of the water and the wastewater system. Exhibit RAW/C-27 shows the water supply and pressure districts boundaries. The condition of PWSA's systems varies, depending on the age, materials employed, local conditions and quality of initial decision or installation. Some of the PWSA's systems require significant capital investment to maintain efficient, safe and reliable service to customers. There is aging infrastructure in the water distribution system (i.e., 700 miles of small diameter main with an average age of more than 80 years) and the wastewater collection system (the Core System is more than 100 years old).[29] The repair and replacement of eligible property will help reduce main breaks or leaks, which will increase service reliability. With respect to the water distribution system, reduced main breaks or leaks will also improve water quality and pressure to customers, improve available fire flows and reduce non-revenue water. With respect to the wastewater collection system, reduced main breaks or leaks will mitigate both inflow and infiltration (I&I) from rainwater and groundwater and the concomitant risks of blockages or malfunctions.

Q. DOES PWSA HAVE BASELINE LEVELS OF REPAIR AND REPLACEMENT IN PLACE?

A. Yes. Without acceleration, PWSA was replacing two miles of small diameter main per year. In addition, without acceleration, PWSA was replacing about one hundred hydrants per year. Without acceleration, PWSA was spending less than $3 million annually on sewer projects.

[29] PWSA's separate stormwater assets are relatively new, with most being installed in or after 2015.

Q. HOW DOES PWSA PRIORITIZE REPAIRS AND REPLACEMENTS?

A. For the water system to date, PWSA based prioritization on the likelihood and consequences of failure as well as water quality impacts.[30] Future prioritization will be based upon PWSA's upcoming Water System Master Plan study to be completed by the end of 2019. The analysis performed as part of this process will support the planned capital spending under the LTIIP over the next five years and establish a long-term approach to renewal and replacement in the water and sewer system. In order to cost-effectively prioritize future sanitary sewer rehabilitation, PWSA will employ a risk-based approach using the National Association of Sewer Service Companies (MASSCO) Pipeline Assessment Certification Program (PACP), which is an industry standard for performing condition assessments. This condition assessment scoring will be reviewed in conjunction with potential consequence of failure (CoF) in order to develop a prioritized program of renewal and replacement. This study will be completed through the Sewer System Master Plan, which will be completed by the end of 2019, to prioritize the neighborhoods and/or pipe segments that are included in the annual projects. In 2019, PWSA is focusing on lining areas identified as having high concentration of sewer defects, location, and/or regulatory compliance obligation. By lining, PWSA intends to reduce the amount of sewer spot repairs or spot lining activities performed by On Call Construction Contractors and reduce the infiltration and inflow entering the sanitary sewer system.

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30 LTIIP at 20.

Q. PLEASE DESCRIBE PWSA'S RECOMMENDED ACCELERATED REPLACEMENT PROGRAM?

A. PWSA formulated a five-year accelerated replacement program for the 2019-2023 timeframe. This program is designed to address critical water supply risks, and begin the renewal of the small diameter water mains which are prone to failure and cause constant service disruptions throughout the system.

As detailed in the LTIIP, PWSA will prioritize the acceleration of (a) the lead service line replacement ("LSLR") program and (b) the Small Diameter Water Main Replacement ("SDWMR") program. Such repair and replacement will be made in conjunction with the other plans set forth in PWSA's Compliance Plan and Capital Improvement Plan. LSLR will be authorized and funded (at an accelerated rate) in 2019 and the first half of 2020.[31] The number of miles of main replacement per year under annual SDWMR program is being accelerated with the goal of eliminating all lead service lines from the system by 2026, as shown in Tables 2-7 and 2-8 of the LTIIP.

In addition, with acceleration, over the next five years, PWSA will spend an average of more than $30 million annually on sewer projects, much of which is devoted to lining "sewer pipes" and reinforcing or removing sewers under structures to minimize the risks of failure.

[31] The Authority submitted an application to the Pennsylvania Infrastructure Investment Authority (PENNVEST) for $50 million in funding for a LSLR program in 2019.

Q. IS THE PROPERTY PROPOSED TO BE REPLACED ELIGIBLE PROPERTY UNDER ACT 11 OF 2012[32] ("ACT 11")?

A. Yes. The LTIIP only addresses property eligible for DSIC recovery. The property proposed to be replaced is DSIC-eligible under Section 1351 of the Public Utility Code. The LTIIP includes an inventory and discussion of the eligible property.

Q. WHAT IS THE COST OF THE PROPOSED ACCELERATED REPLACEMENT PROGRAM?

A. PWSA estimated on average that the annual cost of the accelerated replacement program in the LTIIP over the next five years is more than $95 million per year for water projects and about $30 million per year for sewer projects. See LTIIP at 42, Table 5-1. The schedule for planning, rehabilitation and replacement is provided in Section 2.5, 3.4 and 4.2 of the LTIIP. Those Sections provide the estimated quantities of property to be improved and the projected annual expenditures.

Q. HOW WILL THESE ADDITIONAL COSTS BE RECOVERED?

A. The amount needed to implement PWSA's accelerated replacement program will be recovered from ratepayer dollars (e.g., cash reserves or PAYGO funds), borrowed funds (e.g. lines of credit, loans or bonds) or grants.

That being said, since PWSA has elected not to file a DSIC at this time, an updated/revised LTIIP will be submitted by PWSA to support the DSIC mechanism.[33] That revised LTIIP will have segregated costs for water, sewer and stormwater assets.[34] Once the DSIC is approved, PWSA will use that mechanism to help fund and support the

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32 Act 11 of 2012 (P.L.72, No.11) *inter alia*, added Subchapter B to Chapter 13 of the Public Utility Code which allows jurisdictional water and wastewater utilities to petition the Commission for approval to implement a DSIC. See 66 Pa.C.S. § 1350-1360.

33 *See* PWSA's Compliance Plan at 98-103.

34 *See* Compliance Plan at 99, 101, 101.

accelerated work schedule proposed in the revised LTIIP. Accelerated repair and replacement will allow PWSA to continue to provide adequate, efficient, safe, reliable and reasonable service to its customers.

Q. WHAT MEASURES HAS PWSA TAKEN TO ENSURE THAT ITS LTIIP IS COST-EFFECTIVE?

A. PWSA has taken a number of steps to ensure that the LTIIP is implemented in a cost-effective manner. First, master plans for both the water distribution system and sewer system are to be completed in 2019 to ensure responsible prioritization of assets for future renewal programs. Second, PWSA has upgraded its specifications and contract documents to improve the quality of construction bids. This effort has already reduced the costs of consecutive bids for annual oncall bid projects and the costs for the second round of LSLR construction contracts. Third, PWSA has added and is aggressively recruiting senior staff to assist with the management of the LTIIP projects and additional controls have been enacted to provide extensive, interdepartmental collaboration within PWSA. An example of this collaboration exists via active and regular participation of Engineering, Finance and Operations department representatives to define, update, manage and deliver aggressive project schedules and deliverables.

Q. WHAT MEASURES HAS PWSA TAKEN TO ENSURE THAT ITS LTIIP MAINTAINS ADEQUATE, EFFICIENT, SAFE, RELIABLE AND REASONABLE SERVICE?

A. PWSA's detailed master planning approach will document the analysis and methodologies used to assess the water and sewer systems and develop a comprehensive system of rehabilitation and replacement to ensure the systems are adequate, safe and provide the levels of service required by the DEP, EPA and Commission. Current projects now under design and construction are intended to provide backup facilities to

ensure that the system can continuously satisfy water demands to the entire system, without incurring widespread water loss during power outages or equipment failures. These improvements include: (1) new pump stations to ensure flow to the Highland 1 District should the primary supply pumps at the Bruecken PS go offline; (2) upgrading the Highland 1 water treatment plant to serve the Highland 1 pressure district; and, (3) standby power facilities to address power outages.

Q. DOES PWSA HAVE ADDITIONAL PROCESSES IN PLACE TO ENSURE THAT THE LTIIP MAINTAINS SAFE AND RELIABLE SERVICE?

A. PWSA continues to hire additional staff to expand and improve the equipment maintenance activities, and to avoid premature equipment failures. Also, PWSA has begun to establish written Standard Operating Procedures to facilitate staff training and performance.

Q. DOES PWSA HAVE A WORKFORCE MANAGEMENT PLAN TO ENSURE THAT THE PROPOSED IMPROVEMENTS AND REPLACEMENT WORK IS PERFORMED IN A COST-EFFECTIVE, SAFE AND RELIABLE MANNER?

A. Yes. PWSA currently has structures and qualified staff in place for the prioritization, design, contracting, execution and cost control of repair and replacement projects. PWSA's workforce management and training program is described in Section 7 of the LTIIP. PWSA's program of On Call Consultants and independent consultants to provide detailed engineering design and construction phase services also supports PWSA's current and future workforce to assist with implementation of its CIP in a timely and cost-effective manner. PWSA recognizes the need to maintain a mix of internal staff and On Call Consultants as the program needs increase with the goal of transitioning both system knowledge and project responsibilities from On Call Consultants to PWSA staff.

Q. WHAT OTHER MEASURES HAS PWSA TAKEN IN THIS REGARD?

A. PWSA has taken a number of proactive steps to increase the probability of a successful CIP implementation. Our program includes: improved Project Management Training and required PMP Certification of our project managers, training of operations maintenance staff to improve operator performance, and improvements to our capital project bidding documents and processes to optimize the rate of project delivery.

Q. CAN YOU PROVIDE MORE INFORMATION ABOUT PWSA'S PROJECT MANAGEMENT TRAINING ("PMT") COURSE?

A. Yes, PWSA plans to initiate this during the first quarter of 2019. This PMT is being designed to accommodate intensive training of current staff, ideally 2 classes of 10 staff each, while establishing a foundation of prerequisites for PWSA project managers to obtain CPMP certification from PMI. This short and longer term training strategy promotes the advancement of current project management skills immediately, while increase consistency in project delivery to positively influence successful project outcomes.

Q. WILL OTHER TRAINING BE MADE AVAILABLE TO PWSA STAFF?

A. Yes, in 2019, DEP will provide on-site training at PWSA. In early March, the DEP will provide water treatment plant staff with relevant "contact time" training and overview. Recognizing the shortage of certified water treatment plant operators, PWSA has further partnered with DEP who have agreed to provide pre-certification classroom training at PWSA this spring. The following key and relevant DEP training modules will be covered: Module 1: General Overview; Module 19: Membrane Filtration, Subclass 6; Module 20: Corrosion control Treatment Training, Subclass 7; Module 21: Chemical Addition, Subclass 8; Module 25: Hypochlorite, Subclass 12; Module 26: UV

Disinfection, Subclass 13; and Drinking Water Basic Math. PWSA participants will attend the training classes that are relevant and meaningful to operators. The staff will then afforded the opportunity to take the certification exams to further ensure that PWSA is served best by trained and competent operators.

Q. DOES PWSA HAVE TRAINING PROGRAMS IN PLACE TO ENSURE THAT WORK IS PERFORMED IN A SAFE AND EFFICIENT MANNER?

A. Yes. PWSA has organized training for: safety of all staff, certification of facility operators (provided by the PADEP, project management and staff management. In addition, we provide training in Human Resources to address management/staff interaction and addressing difficult employees.

Q. DOES PWSA HAVE A PLAN FOR OUTREACH AND COORDINATION WITH OTHER UTILITIES REGARDING THE PLANNED PROJECTS AND ROADWAYS THAT MAY BE IMPACTED BY THE LTIIP?

A. Yes. PWSA's outreach and coordination activities are described in Section 8 of the LTIIP. We are currently working to develop a collaboration program with PA One Call with the assistance of the Commissioners.

Q. PLEASE DESCRIBE PWSA'S INITIAL SCHEDULE FOR THE PLANNED REPAIR AND REPLACEMENT OF ELIGIBLE PROPERTY?

A. The initial schedule for planning, rehabilitation and replacement of eligible property is set forth in Sections 2.2, 3.2 and 4.2 of the LTIIP.

Q. DOES PWSA'S LTIIP COMPLY WITH ACT 11, THE COMMISSION'S REGULATIONS, AND THE COMMISSION'S ORDERS?

A. Yes. PWSA's proposed LTIIP meets the requirements of the Act 11, the Commission's regulations, and the Commission's Orders. PWSA's LTIIP (1) is in the public interest, (2) contains measures to ensure that the projected annual expenditures are cost-effective, (3) specifies the manner in which it accelerates or maintains an accelerated rate of

infrastructure repair, improvement or replacement (4) is sufficient to ensure and maintain adequate, efficient, safe, reliable and reasonable service.

VII. CONCLUSION

Q. DOES THAT COMPLETE YOUR DIRECT TESTIMONY?

A. Yes.

Direct

Testimony

Exhibits

Kleimar

Sequential numbering of the Directed Questions listed in the PUC Technical Staff Initial Report and Directed Questions (Stage 1), dated November 28, 2018 (as corrected).

Documents Supporting the Compliance Plan

In various locations throughout the Compliance Plan (CP), PWSA indicates that the CP relies on other foundational documents. For example, PWSA references a Capital Improvement Plan at page 22 of the CP and a 40 Year Plan at CP page 28. While some version of these foundational documents may be publicly available, it is unclear which version of these PWSA would use in support of the CP.

1. To that end, PWSA shall introduce into evidence those materials it intends to use as support for the CP. These include, but are not limited to, the following documents referenced in the CP:

   1.1 The Organizational Plan referenced at CP page 9.

   1.2 The formal plan to document all stormwater assets and conditions at CP page 14.

   1.3 Memorandum of understanding between the City and PWSA for operation, maintenance, repair, and capital improvements related to stormwater and the City at CP pages 14-15.

   1.4 The 2017 PWSA prepared responses to the U.S. EPA Municipal Separate Storm Sewer Systems stormwater permit at CP page 14.

   The management audits referenced at CP page 17 including:

   1.5 The Performance Audit Report by the Office of City Comptroller;

   1.6 a City-sponsored assessment by Infrastructure Management Group (IMG); and

   1.7 the Pennsylvania Department of Environmental Protection (PA DEP) and U.S.

   1.8 EPA audits.

1.9 The PWSA Capital Improvement Plan for years 2017 – 2021 referenced at CP page 22.

1.10 The October 25, 2017 Administrative Order of the PA DEP referenced at CP page 22.

1.11 The schedule of Capital Improvement Projects filed by PWSA with the PA DEP on or about November 30, 2017 in response to the October 25, 2017 Administrative Order, if different from the PWSA Capital Improvement Plan for years 2017-2021 referenced at CP page 22.

1.12 The September 18-22, 2017 PA DEP Comprehensive Performance Evaluation for the Aspinwall Water Filtration Plant referenced at CP page 22.

1.13 The Wet Weather Feasibility Study, Wet Weather Plan and Long-term Wet Weather Control Plan referenced at CP page 24 to the extent that these affect the CP.

1.14 The Green First Plan referenced at CP page 25 to the extent that it affects the CP.

1.15 The PWSA 40 Year Plan referenced at CP page 28 (Chester Engineers, n. 28).

1.16 The 12-year plan "Pittsburgh's Water Future 2030 and Beyond."

Projected Expenditures

The PWSA Compliance Plan (CP) at page 7 notes that PWSA will increase its capital expenditures from approximately $60 million in 2018 to $155 million in 2019, $256 million in 2020, and $327 million in 2021.

Parties should discuss:

2. A. PWSA projections beyond 2021 consistent with foundational documents such as the PWSA Capital Improvement Program, the 40 Year Plan, and the LTIIP at Docket Nos. P-2018-3005037 (water) and P-2018-3005039 (wastewater.)

3. B. The specific means and methods by which PWSA will finance such significant increases in annual capital expenditures e.g., with appropriate disaggregation between the sources of funds such as internally generated funds, outside borrowing, and potential grants.

4. C. Each of the projects in the Capital Improvement Plan (CIP) and how PWSA expects to finance those projects.

5. D. Whether the implementation of a Distribution System Improvement Charge (DSIC) is consistent with PWSA's plans to increase capital spending and with the corresponding LTIIP.

System and Operations Activities

The CP at page 22 notes that PWSA is complying with a 2017 Administrative Order from the PA DEP to ensure completion of the most urgent water supply projects. The CP on page 22 also notes that PWSA's CIP will address issues in the Aspinwall Plant and improvements to the rising main system. The CP further states that PWSA utilized PA DEP Administrative Orders to incorporate other key system upgrades and measures to improve system reliability and resilience in the CIP.

Regarding these system reliability and resiliency projects, parties should discuss the following areas:

6. How PWSA will address projects specific to issues identified in the October 25, 2017 Administrative Order and CIP. The individual design engineer, company affiliation and the estimated cost, funding source, timeline, and milestone dates should be identified for each of the following projects:

    6.1 Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Improvements;

    6.2 Aspinwall Treatment Plant Electrical and Backup Power Improvements;

    6.3 Large Diameter Water Main Improvements – Rising Mains 3 & 4 to Highland Reservoirs 1 & 2;

    6.4 Highland Reservoir Pump Station and Rising Main;

    6.5 Aspinwall Water Treatment Plant High Service Pumping;

    6.6 Aspinwall Clearwell Emergency Response Project;

    6.7 Aspinwall Clearwell Improvements;

    6.8 Aspinwall Pump Station to Lanpher Reservoir Rising Main Project;

    6.9 Lanpher Reservoir Improvements;

6.10 Washout Disconnection Project;

6.11 Highland Park Membrane Filtration Plant Improvements Project; and

6.12 Bruecken Pump Station Improvements Project.

7. How PWSA will address the following projects specific to issues identified in the November 17, 2017 PWSA-PA DEP Consent Order and Agreement including the identity of the individual design engineer and the estimated cost, funding source, timeline, and milestone dates for each of the following projects:

7.1 Addition of Several Orthophosphate Injection Points and Equipment for Corrosion Control Project;

7.2 Lead Service Line Replacement Project, including how PWSA determined to limit its lead line replacement policy to single-family residential properties with services lines of 1-inch or less.

8. Whether PWSA can compile a list of water supply, production and storage projects and wastewater conveyance projects in a format like that of an LTIIP.

Regarding water supply, production and storage projects and wastewater conveyance projects, the parties should:

9. Describe in detail the process that will be employed when selecting projects to be competitively bid;

10. Describe in detail how bids are solicited for those selected projects. Provide a summary and copy of the procedure(s) controlling the bidding process.

11. Describe if there is an existing contractor pre-qualification process in place and how contractors are evaluated for cost-effectiveness.

12. Provide an approximate number or percentage of projects that are to be competitively bid;

13. Describe any Request for Proposal (RFP) process or procedure utilized by PWSA and provide sample contract and RFP documents, if an RFP process or procedure exists; and

14. Describe how PWSA intends to finance each selected project.

Comprehensive Performance Evaluation

The CP does not address how the CP is integrated with the September 18-22, 2017 PA DEP Comprehensive Performance Evaluation for the PWSA Aspinwall Water Filtration Plant.

15. Parties should discuss whether and how the CP adequately addresses that evaluation of the operation and management of the Aspinwall Water Filtration Plant.

52 Pa. Code § 65.2 - Accidents

The CP at page 49 discusses PWSA's compliance with Chapter 65.

16. Regarding 52 Pa. Code § 65.2, Parties should discuss when and how PWSA intends to notify Commission staff of reportable accidents via the one-page accident form UCTA-8.

52 Pa. Code § 65.7 - Metered Service

The CP at pages 55-56 discusses PWSA's plans for metering customers and indicates that it does not expect to fully comply with the Commission's metering requirements for approximately five years. The CP indicates that PWSA intends to use contractors to achieve full compliance within that time and recover some costs from the City of Pittsburgh (City).

Regarding these proposals, parties should discuss:

17. Why contractors are necessary for this program.

18. Whether the Public Utility Code provides for any proposed charge for meter installation and other related appurtenances (i.e., additional plumbing, meter pits, backflow prevention devices, etc.) and if PWSA's proposed tariff adequately addresses requirements for meter installation and other related appurtenances.

19. Whether the CP complies with the provisions of 52 Pa. Code § 65.7(b) requiring notice to customers that explains the responsibilities of the customer and PWSA regarding meters.

20. Whether and how the 5-year time horizon for the metering of municipal buildings can be accelerated.

52 Pa. Code § 65.8 - Meters

The CP at pages 56-58 indicates that PWSA has as many as 50,000 meters out of compliance with Commission meter testing requirements and plans to achieve compliance by 2022.

Regarding PWSA's plan for meter testing and replacement, parties should discuss:

21. How PWSA might comply with the Commission's metering requirements through detailed year-over-year compliance schedules and supporting documentation.

22. If PWSA's indicated goal to test and replace 10-25% of the 2,800 commercial meters on an annual basis is adequate to achieve compliance by the 2022 goal.

23. The appropriateness of the 2022 goal.

24. Any formulas that PWSA may seek to use to establish rates for testing meters larger than 2 inches.

25. If any meters without test records exist within the system.

26. The adequacy of the meter testing facilities proposed and currently available.

27. The feasibility of immediately implementing a meter testing triage plan with the following hierarchy:

    (a) Testing out-of-compliance meters used to provide high volume service.

    (b) Testing out-of-compliance meters used to provide mid-volume service.

    (c) Testing out-of-compliance meters used to provide residential and other low-volume service.

    (d) Providing for customer-generated meter testing requests.

52 Pa. Code § 65.11 - Mandatory Conservation Measures

The CP at pages 59-60 indicates that jurisdictional utilities shall file plans of their contingent mandatory conservation measures with the Commission as part of their tariff rules and regulations and that, while PWSA does not currently have a contingency plan, the topic is included in the utility's emergency response plan and anticipates compliance by 2020.

28. Parties should examine the language in the PWSA proposed tariff to determine if provisions for voluntary and mandatory water restrictions (pages 60-62 of proposed tariff) are adequately addressed.

29. Parties should review, on a confidential basis, the PWSA Emergency Response Plan.

30. Parties should discuss whether PWSA should aggressively pursue interconnections with other regional water suppliers to enhance system resiliency.

52 Pa. Code § 65.12 - Notice of Desire to Have Service Discontinued

The CP at page 60 indicates that a customer who is about to vacate any premises or who wishes to have service discontinued shall give at least 3 days' notice to the utility, specifying the service discontinuation date.

Parties should discuss:

31. PWSA's proposed tariff, which requires 7 days' notice to discontinue service (pages 41-42 of proposed tariff).

32. The language and format of PWSA's current suspension and termination notices.

33. PWSA's method of providing suspension and termination notices to the customer.

52 Pa. Code § 65.14 - Measurement

The CP at page 61 indicates that PWSA is working with a consultant and several contractors to reestablish operation of the intake meters and an additional meter at Fox Chapel Pump Station to be operational at end of 2018.

Parties should discuss whether:

34. This aspect of the CP satisfies Section 65.14 (b).

35. This work should be detailed and included in PWSA's Capital Improvement/Investment Plan.

36. The CP adequately addresses the raw water meter analysis presented in the PWSA 40 Year Plan of 2012 at page 4-40, Table 4-3.

52 Pa. Code § 65.16 - System of Accounts

The CP at page 63 indicates that PWSA will have the ability to generate reports of financials under the NARUC uniform system of accounts (NARUC USOA) as early as 2020, but no later than 2021.

Parties should discuss whether:

37. The PWSA proposal to generate financial reports by the NARUC USOA, in lieu of a full conversion to the NARUC USOA, adequately complies with Section 65.16.

38. The PWSA proposed timeline for implementation is reasonable and appropriate.

52 Pa. Code § 65.17 - Standards of Design

The CP at page at 64 indicates that PWSA has been actively working to replace all 4-inch diameter distribution mains to comply with Section 65.17, and that there are still 27 miles of 4-inch diameter main remaining in the system.

Parties should discuss:

39. Where the 27 miles of 4-inch diameter mains exist in PWSA's distribution system.

40. When PWSA plans to have the 27 miles of 4-inch diameter mains replaced with pipe of a diameter of 6 inches or greater.

52 Pa. Code § 65.20 - Water Conservation Measures

The CP at page 67 indicates that PWSA does not currently meet the Section 65.20 standard.

Parties should discuss and explain:

41. How PWSA will meet the requirements of Section 65.20 (1)-(7).

42. How PWSA's leak detection efforts will be incorporated into its Capital Improvement/Investment Plan.

43. Whether the CP adequately addresses the leak detection issues identified in the PWSA 40 Year Plan of 2012 at Task 4.7 pages 4-34 through 4-48.

52 Pa. Code § 65.21 - Duty of Public Utility to Make Line Extensions

The CP at pages 67-69 indicates that PWSA does not plan to comply with Section 65.21, and will instead, subject to Commission approval, follow the PWSA Policies and Procedures related to line extensions, as provided in its 2018 Tariff Filing Rules and Regulations and as permitted by the Municipality Authorities Act.

Parties should discuss:

44. The appropriateness of PWSA following the Municipal Authorities Act in lieu of the Public Utility Code.

45. PWSA proposed tariff rules and regulations related to line extensions to evaluate compliance with the Public Utility Code.

52 Pa. Code § 65.22 - Customer Advance Financing, Refunds and Facilities on Private Property

The CP at pages 68-69 indicates that PWSA's policy on line extensions is detailed in the rules and regulations section of its tariff filing and is consistent with the requirements of the Pennsylvania Municipality Authorities Act.

Parties should discuss:

46. The appropriateness of PWSA following the Municipal Authorities Act in lieu of the Public Utility Code regarding Section 65.22.

47. PWSA proposed tariff rules and regulations, related to customer advance financing, refunds and facilities on private property to evaluate compliance with the Public Utility Code.

52 Pa. Code § 65.23 - Special Utility Service

The CP at page 69 indicates that PWSA policy on line extensions is detailed in the rules and regulations section of its tariff filing and is consistent with the requirements of the Pennsylvania Municipality Authorities Act.

Parties should discuss:

48. The appropriateness of PWSA following the Municipal Authorities Act in lieu of the Public Utility Code regarding line extensions.

49. PWSA's proposed tariff rules and regulations, related to customer advance financing, refunds and facilities on private property to evaluate compliance with the Public Utility Code.

50. PWSA's understanding of Special Utility Service versus line extensions under 52 Pa. Code § 65.21.

52 Pa. Code § 67.1 - Service Outages

The CP at pages 70-71 indicates that, while PWSA currently has a process to notify the Commission for unscheduled service interruptions as required by Section 67.1(b), PWSA is in the process of updating its emergency response plan to include a comprehensive standard operating procedure (SOP) related to notifying the Commission during periods of unscheduled service interruptions, to be completed within the next 6 months.

51. Parties should discuss how the notification process developed in the SOP for Section 67.1 comports with the notification SOPs developed for 52 Pa. Code §§ 65.2, 65.11, and 69.1603.

52 Pa. Code § 69.87 - Tariff Provisions That Limit the Liability Of Utilities for Injury or Damage as a Result of Negligence or Intentional Torts

The CP at page 73 indicates that PWSA includes a limitation of liability section on page 58 of its proposed water tariff and on page 52 of its proposed wastewater tariff.

Parties should discuss:

52. The company-specific dollar amount for the proposed limitation that will become effective at the time PWSA's proposed tariff is approved.

53. The reasonableness of the company specific dollar amount and how that amount was calculated, including the potential applicability to intentional torts, and incidents involving the actions of third parties where the physical and cyber protection of PWSA's facilities and systems may be at issue.

54. Application of the tariff to matters involving the replacement of PWSA and customer-owned lead water service lines.

52 Pa. Code § 69.169 - Policy Statement Interpreting Terms Included in 66 Pa. C.S. § 1326, *Standby charge*

The CP at page 74 indicates that the PWSA private fire protection charge is not the same as an impermissible "standby charge."

Parties should discuss:

55. If PWSA's charge conforms to 66 Pa. C.S. § 1326 and the definition in 52 Pa. Code § 69.169.

56. Whether residential customers are served by separate domestic and fire service lines.

52 Pa. Code § 69.261 - Customer Assistance Program (CAP)

The CP at pages 75-76 indicates that, while 52 Pa. Code Sections 69.261 – 69.267 apply only to electric and large natural gas companies, PWSA has nevertheless implemented a CAP developed on Commission recommended designs and has modeled its CAP on a program used by the Pennsylvania-American Water Co.

Parties should discuss:

57. Whether and how the PWSA CAP complies with 52 Pa. Code § 69.265(1) and § 69.266 and 66 Pa. C.S. § 1304.

58. The appropriateness of PWSA establishing a CAP.

59. The appropriateness of PWSA dedicated funding for private lead line replacements for CAP customers only and if this complies with 66 Pa. C.S. § 1304.

60. The reasonableness of PWSA's private lead line replacement project for CAP customers considering the recent October 17, 2018 PENNVEST loan and grant awarded to PWSA.

52 Pa. Code § 69.1601 - Unscheduled Service Interruptions and Associated Actions

The CP at page 79 identifies that the PWSA existing emergency management plan (EMP) addresses the emergency management procedures described in 52 Pa. Code Sections 69.1601 - 69.1603. The CP also indicates that PWSA is currently in process of updating its EMP to follow the National Incident Management System's public information system according to 52 Pa. Code Section 69.1602.

61. Parties should discuss how PWSA may comply with the notice provisions of 52 Pa. Code § 69.1603 which require notice to Commission personnel as soon as possible upon a utility becoming aware of an unscheduled service interruption.

52 Pa. Code § 73.3 - Annual Depreciation Reports

The CP at page 87 indicates that PWSA does not currently have the capability to produce a depreciation report that includes the detail the Commission requires. The CP further indicates that PWSA plans to comply with the requirements listed in 52 Pa. Code Section 73.3 and file its first annual depreciation report with the Bureau of Fixed Utility Services within 5 years.

Parties should discuss:

62. Whether PWSA employs enterprise fund governmental accrual accounting and whether this is required by law or regulation for reporting purposes. If PWSA does use enterprise fund governmental accounting, parties should provide detail on the current accrual accounting employed by PWSA regarding:

    62.1 Capitalization.

    62.2 Depreciation of property, plant, and equipment fixed assets.

    62.3 Long-term liabilities and any accrued unfunded pension plan liability disclosed and listed on the PWSA balance sheet.

63. Whether PWSA will be required to file a waiver requesting relief from filing this report.

64. The appropriateness of PWSA's plan to file an annual depreciation report meeting the requirements of Section 73.3 within 5 years.

65. Whether PWSA could file a partial annual depreciation report detailing only known and newly constructed assets.

66. Whether accurate depreciation accounting and reporting is relevant and necessary for the potential implementation of a distribution system improvement charge (DSIC) mechanism.

52 Pa. Code § 73.5 - Service Life Study Report

The CP at page 89 indicates that PWSA plans to file a service life study report with the Office of Special Assistants every five years, filing its first report within 5 years from the beginning of its Commission regulation, April 1, 2018.

67. Parties should discuss the feasibility of PWSA providing a service life study report detailing all known and newly constructed assets and the appropriateness of PWSA's plan to file a service life study report within 5 years.

    Parties should note that the report should be filed with the Commission's Bureau of Technical Utility Services, not with the Office of Special Assistants.

52 Pa. Code § 73.7 - Capital Investment Plan Report

The CP at page 90 states that PWSA's most recent Capital Improvement Plan was completed in 2017 for the period of 2017 through 2021. However, PWSA plans to file its long-term infrastructure improvement plan (LTIIP) in the place of capital investment plan (CIP) report.

Parties should discuss:

68. Whether the CIP should be considered in conjunction with the LTIIP.

69. How PWSA will provide cost information to the Commission for projects that are not included in its LTIIP.

52 Pa. Code § 101 - Public Utility Preparedness through Self-Certification

The CP at pages 93-94 identifies PWSA plans to within the next 6 months develop physical security, cyber security, emergency response, and business continuity plans that meet the requirements of Chapter 101 of the Commission's regulations.

70. Parties should discuss whether PWSA should consult with Commission staff regarding its completed plans similar to the consultation directed by the Commission in its Order of August 11, 2016, approving the sale of Pike County Light and Power Company at Docket No. A-2015-2517036, Ordering Paragraph 20.

PWSA Relationship with the City of Pittsburgh

PWSA Services Contract with the City of Pittsburgh (Cooperation Agreement)

The CP at page 107 indicates that PWSA will negotiate with the City to revise the Cooperation Agreement (CP Appendix B) and file the revised agreement under 66 Pa. C.S. § 507 by December 31, 2018. The CP indicates that if the agreement cannot be negotiated by December 31, 2018, it may be appropriate for the Commission to institute an investigation to determine 1) the services provided to PWSA by the City and 2) the associated costs. The CP also indicates that this agreement will address public fire protection. The CP further indicates that after the investigation the Commission should utilize its power under 66 Pa C.S. § 508 to vary or reform the agreement as necessary.

CP Appendix B consists of a copy of the cooperation agreement between PWSA and the City of Pittsburgh, effective January 1, 1995. The agreement provides, among other things, that the City provide certain ongoing services to the PWSA and PWSA is to compensate the City for those services.

Regarding the Cooperation Agreement, parties should discuss:

71. Those services and related costs that PWSA can identify and quantify and the basis for those costs, e.g., market, cost plus, or other method.

72. Whether PWSA can identify all categories of costs associated with the Cooperation Agreement.

73. Whether PWSA receives any services from the City of Pittsburgh at no cost.

74. The potential for PWSA to terminate the Cooperation Agreement with the City, or otherwise allow the agreement to lapse, in favor of market-based procurement practices.

75. Whether the Cooperation Agreement, or any other agreement, provides the City with free or discounted wastewater service, stormwater service, or otherwise restricts the application of non-consumption fixed charges (i.e., customer charges) for water service.

76. The extent to which the Public Utility Code overrides the binding arbitration provisions of the Cooperation Agreement.

77. As recommended at CP page 107, whether the Commission may exercise jurisdiction under 66 Pa. C.S. § 508 to revise the Cooperation Agreement and the most appropriate procedural vehicle for any such revision.

Capital Lease Agreement

The CP at page 107 indicates that PWSA satisfied the minimum lease payment terms of the Capital Lease Agreement with the City of Pittsburgh during the initial three years of the Capital Lease Agreement and that PWSA may acquire all system assets for $1 in 2025.

Parties should discuss whether:

78. A. PWSA has provided the City of Pittsburgh with equivalent compensation for the value of PWSA since the inception of the Capital Lease Agreement.

79. B. The City's acceptance of that consideration/compensation binds the City to the $1 transfer of 2025 if PWSA seeks to exercise that option.

Residency Requirement

The CP does not discuss whether any residency requirements may apply to applicants for employment with PWSA or to PWSA employees.

80. The parties should discuss whether employment with PWSA is subject to a residency requirement, and if so, how.

81. Parties should also discuss how such residency requirements for employment are consistent with PWSA safety and reliability obligations under the Public Utility Code and 52 Pa. Code §§ 69.801 – 69.809.

Unmetered and/or Unbilled Usage (including City Usage)

The CP at pages 108 - 110 indicates that PWSA is aware of between 200-400 City-owned and/or operated locations where it either does not bill the City for water service or where it neither meters nor bills the City for water service. The CP indicates that PWSA estimates that all unbilled and unmetered facilities can be metered within five years and proposes to implement rates by a phase-in approach, with the City not fully billed until the fifth year that the meter is in place (20% first year, 40% second year, etc.).

Parties should discuss:

82. Estimated revenue loss associated with unmetered and unbilled usage.

83. The legality of the proposed PWSA step billing approach.

84. The feasibility of estimating usage based on engineering estimates on all currently unmetered customers and billing immediately based on those estimates.

85. Whether initiating the 20/40/60/80/100 percent step billing proposal immediately based on those engineering estimates would be feasible and legal.

86. Whether any 20/40/60/80/100 percent billing program should be phased as opposed to stepped.

87. The feasibility of immediately applying the monthly customer charge to any known but unbilled or unmetered customer prior to the installation of a meter.

88. The feasibility of immediately implementing a metering and billing triage plan with the following hierarchy:

    88.1 Metering/estimating and billing high volume customers.

    88.2 Metering/estimating and billing mid-volume customers.

    88.3 Metering/estimating and billing residential and other low-volume customers.

89. If any of the 200-400 City-owned and/or operated locations that are unbilled for water service are billed for wastewater service.

90. How PWSA plans to address and implement charges for public fire hydrants.

Billing Arrangement with the Allegheny County Sanitary Authority (ALCOSAN)

The CP at page 112 indicates that PWSA is proposing to impose a surcharge on its customers to account for uncollected revenue, billing, and collection expenses associated with ALCOSAN wastewater treatment charges.

Regarding this proposal parties should discuss:

91. Why PWSA is responsible for ALCOSAN receivables if it merely serves as an ALCOSAN billing agent.

92. Whether and why it is reasonable for PWSA to purchase ALCOSAN receivables at 100% of the outstanding balance.

93. Whether disputed ALCOSAN charges should be re-coursed to ALCOSAN because services provided by ALCOSAN may be non-jurisdictional.

94. Whether PWSA may terminate a customer because the customer failed to pay what may be a non-jurisdictional charge.

95. Whether the Commission has the authority to revise the PWSA contract with ALCOSAN pursuant to 53 P.S. §§ 3102.501-3102.507, 66 Pa. C.S. §508 or any other applicable statute.

Billing Arrangement with Pennsylvania-American Water Company (PAWC)

The CP at page 112 indicates that PWSA is proposing that the subsidy payment to PAWC be eliminated in PWSA's next base rate case for water service.

96. Parties should discuss the feasibility of setting a date certain by which this subsidy shall be eliminated or phased out.

Plan to Address Lead Levels in Water Supply and the Replacement of Lead Service Lines

The CP at pages 119-120 reiterates that the Commission directed the CP to address, inter alia, lead levels in the water supply and replacement of lead service lines.

Regarding PWSA's outlined plan to continue lead service line replacements, parties should discuss:

97. PWSA's continued funding of the replacement program beyond 2019.

98. The reasonableness of PWSA's private lead line replacement plan considering the recent October 17, 2018 PENNVEST loan and grant awarded to PWSA.

99. PWSA's criteria or policy for replacing customer owned lead service lines and whether or not this policy complies with 66 Pa. C.S. § 1304.

100. Whether the PWSA lead line replacement policy of limiting replacements to single-family residential properties with service lines of 1-inch or less is consistent with 66 Pa. C.S. § 1501.

101. The relationship between the replacement program for customer-owned lead service lines and the potential implementation of a DSIC mechanism.

Plan to Address Non-Revenue Water

The CP at page 121-122 indicates that PWSA is not able to make a meaningful assessment of its Non-Revenue Water (NRW) because it lacks an accurate means of determining flows into and out of the water distribution system. The CP indicates that PWSA estimates NRW at 50% of water produced and plans to have meters in place by 2021 and that PWSA also plans to implement a comprehensive leak surveying program consistent with AWWA standards and procedures.

In addition, the PWSA 40 Year Plan of 2012 indicates at page 4-36, table 4-2 that while domestic average daily metered consumption has declined approximately 64% from 1996 to 2009 consistent with declines in population (page 4-35, figure 4-48), domestic average daily *unmetered* consumption increased over that time. Also, table 4-2 shows that unaccounted for water increased approximately 144% and the Other category increased approximately 682% over that same period.

In reviewing PWSA's plan to address NRW, parties should discuss:

102. The PWSA definitions of NRW and Lost and Unaccounted for Water and how those definitions may differ from those commonly used by the Commission.

103. The adequacy of PWSA's plan to address NRW and unaccounted-for water.

104. The appropriateness of the proposed meter installation timeline.

105. When PWSA intends to file its first AWWA Water Audit (Due April 30th Annually) with the Commission as required by the November 10, 2011 Final Implementation Order at Docket M-2008-2062697.

106. The timeline for implementation of a comprehensive leak surveying program and the associated costs.

Bulk Water: Sales for Resale

The CP at page 123 indicates that PWSA has contracts for the sale of water by PWSA to other water utilities or public authorities, and to the extent deemed necessary, sales for resale agreements will be dealt with in PWSA's next water base rate cases. In addition, the PWSA 40 Year Plan of 2012 lists 14 interconnections through which PWSA provides water to neighboring systems (page 2-16, Table 2-3).

Regarding PWSA compliance to 66 Pa. C.S. § 507, parties should discuss:

107. Why PWSA should not immediately file with the Commission copies of its current contracts and/or agreements for the sale of water to other water utilities or public authorities, pursuant to 66 Pa. C.S. §§ 505 and 507.

108. Whether such unfiled agreements are valid under the Public Utility Code.

109. Whether each contract and/or agreement adheres to PWSA tariffs.

110. Whether PWSA maintains a map of all interconnection points its distribution system with other public water service providers.

111. Whether each interconnection is subject to emergency use only or if it is used to provide bulk water sales.

112. Whether each interconnection is metered.

113. Any issues related to the estimated water loss provision of the Pittsburgh & Municipal Authority of the Borough of West View 1979 Agreement.

Bulk Wastewater Conveyance Agreements

The CP at page 124 indicates that PWSA has contracts for the conveyance of wastewater from other utilities or public authorities through PWSA's wastewater conveyance system to ALCOSAN's system and proposes that to the extent deemed necessary, bulk wastewater conveyance agreements will be dealt with in PWSA's next wastewater base rate cases.

In addition, the PWSA 40 Year Plan of 2012 indicates at page 2-19 that PWSA provides wastewater conveyance to 23 neighboring municipalities. Page 2-20, figure 2-2 of the 40 Year Plan indicates that PWSA provides direct flow to 19 municipalities and another 9 municipalities for which PWSA provides service via inter-municipal connections. Further, page 2-23, figure 2-6 of the 40 Year Plan appears to indicate that 26 municipalities are tributary to PWSA sewer systems.

When reviewing issues surrounding PWSA bulk wastewater conveyance agreements parties should discuss:

114. Whether PWSA is required to file with the Commission copies of its current contracts and/or agreements for wastewater conveyance with other utilities, municipalities, or public authorities, pursuant to 66 Pa. C.S. §§ 505 and 507.

115. If the terms of any existing bulk wastewater conveyance agreements have the effect of causing PWSA to provide wastewater conveyance at a financial loss.

116. The cost structure and standards by which future bulk wastewater conveyance agreements will be examined to determine an appropriate incremental system contribution.

117. Whether systems that utilize PWSA wastewater conveyance infrastructure should be required to contribute to the integrity of that infrastructure.

118. If PWSA intends to be financially responsible for both conveyance and treatment costs for bulk wastewater customers long-term.

119. If the provisions of the PWSA O'Hara Township 1991 Shut-off Agreement are consistent with termination procedures in 53 Pa. Stat. §§ 3102.501-3102.507.

120. The scope, potential rate effect, and status of any existing, proposed or contemplated agreement between PWSA and ALCOSAN for the transfer of operation and maintenance responsibilities for certain multi-municipal trunk line sewers currently operated and maintained by PWSA.

Exhibit RAW/C-2

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-1 Reference Section 1.2: Pittsburgh Water and Sewer Authority History and System Overview

a. The LTIIP does not provide any details on the materials of the water and sewer mains. Is PWSA incapable of providing details on the material makeup of the water and sewer mains? If so, explain in detail why.

Response: At this time, PWSA cannot produce a comprehensive report on the material makeup of all its water and sewer mains. The water mains in PWSA's system are comprised of cast iron, riveted steel, wrought iron, ductile iron and small quantities of high density polyethylene (HDPE) and pre-stressed concrete cylinder pipe (PCCP) (Noted in 2.1, page 11). The materials of construction of the sewer lines and length in miles are presented in Table 3.3 and include: vitrified clay pipe (VCP); concrete/reinforced concrete pipe (RCP), brick, polyvinyl chloride (PVC), cast/ductile iron, and corrugated metal pipe (CMP). The repository for the pipe information is included in PWSA's GIS. However, the database has not been fully populated with main installation date or material. Currently, confirming pipe material or installation date is a process of looking up scanned or hard copy record books. PWSA is in the process of updating the information, transferring the information from paper maps to the electronic system. Once this process is completed PWSA will be able to provide a comprehensive materials report.

Response provided by: Robert A. Weimar, Executive Director, PWSA

licenses. The PWSA Project Managers are assigned projects based on their experience and availability. Of contracted LTIIP projects, where a consultant is hired to design the project, the PWSA PM's role is to provide technical review (or manage the technical reviews to be undertaken by third party reviewers), provide background assistance, coordinate with Operations and other PWSA Departments, and ensure schedule, budget and PWSA rules and procedures are being followed, and assist with the preparation of bid documents (front end legal and general conditions documents). The PWSA PM will also manage the procurement of constructability reviews and construction management/construction inspection services. Shop drawings are generally reviewed by PWSA's engaged design consultant. All documents produced by consultants to PWSA will be reviewed by the PM to ensure that the project goals are met, and that the PWSA standards are incorporated in the documents.

d. PWSA has sustained a relatively high rate of hires for several years, largely to address the increased workload and replacement of retirees. In 2018, PWSA hired 76 individuals for all sectors of the organization. Many staff were required to build our engineering department capacity, finance and procurement, as well as providing professional trades people and laborers for operations. Therefore, we do not anticipate our ability or capacity/budget to complete the hiring process to meet these staff hiring projections.

The critical issue to fill these positions is the ongoing limited pool of qualified candidates for our mid-level and senior engineering and technical staff as well as the operations department plumbers and other tradesmen. The Authority's current domicile requirement has severely restricted our candidate pool for many key positions. While clerical and customer service positions are readily filled from Pittsburgh residents, operations and engineering positions have few candidates to select from, and in many cases, PWSA accepts a person with no experience with the understanding that significant training will be required. For example, treatment plant operators have been hired with no expertise, with their likely positions to grow from a general laborer position to operator over several years. For plumbers, advertised positions since November have yielded no candidates to interview. In another case, the Director of Engineering and Construction position has been posted for more than a year with only one candidate application from a person who does not live in Pittsburgh.

The job market locally is flush with opportunity at this time from large projects worth more than $5 Billion, which has resulted in fewer candidates and longer periods to fill them to the extent staff are available. Our goal is to fully staff the organization to achieve the rate of various operational and maintenance projects that are proposed in our Tariff, LTIIP and Compliance Plan.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-12 Reference Section 7: Workforce Management and Training Program

a. How many engineers are currently on staff with PWSA and how many will be hired in 2019 and through 2023?

b. How may licensed Professional Engineers does PWSA currently have on staff and how many will be hired through 2023?

c. Describe specifically how staff engineers are involved in the LTIIP process and projects. For example, is a staff engineer or engineers assigned to each LTIIP project for conception, design and oversight? For contracted LTIIP projects and work, describe how staff engineers are involved in the process.

d. PWSA appears to be planning to hire 101 new full-time employees in 2019 and 122 additional full-time employees by 2023. Detail the approximate additional costs associated with such a large increase in staff, including the approximate additional annual salaries, annual training costs, onboarding costs, and additional human resources costs

Response:

a. PWSA's staff currently includes 12 engineers. PWSA is currently looking to hire an additional 28 engineers and Project Managers during 2019 and will work to maintain this level of technical expertise through 2023.

A clarification is provided to differentiate between the roles of our PWSA staff engineers and our staff Project Managers (PM). PWSA staff engineers have generally graduated with a four-year technical or engineering degree, while our Project Managers do not necessarily have engineering degrees but have previously worked for a minimum of 10 years of experience in a technical position, and 5 or more years managing projects.

b. Two of the PWSA staff engineers noted above maintain their Professional Engineer's license. PWSA's consultants providing embedded, full time services at PWSA account for an additional nine (9) licensed Professional Engineers.

c. PWSA Project Managers are assigned projects. Some projects are completed (conception, design and construction oversight) in-house by PWSA staff, such as the Hydrant Replacement Contract whereas some projects are designed by outside professional engineering consultants, such as the small diameter main replacement program or the Chlorine Booster Station improvements. The PWSA Project Managers are mostly engineers, but only a few have professional engineering

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-11 Reference Section 5: Summary of Past and Projected Capital Spending

a. Provide specific details on how PWSA will finance the significant increase in annual capital expenditures outlined in Table 5-1.

Response:

The outstanding capital line of credit and revenue bonds will be utilized to fund all capital projects. The PWSA will also continue to explore PENNVEST funding opportunities. If future PENNVEST monies are awarded, the amount of the award will replace what would have been funded by revenue bonds.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Exhibit RAW/C-2

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-10 Reference Section 4.1: General Description of Eligible Hybrid Projects

a. Provide a table or tables that detail(s) PWSA's historic replacement of the DSIC-eligible materials by year for each of the years 2013 through 2017 for each of the identified major project categories:
i. Utility Cost Shares
ii. Smallman Street Reconstruction
iii. Maytide Storm and Sanitary Sewer System Improvements

Response:

a(i)
Utility Cost Shares

Project Type	2014	2015	2016	2017
Utility Cost Share	$ 2,375,439.40	$ 309,689.12	$ 849,579.12	$ 4,330,526.17

a(ii) Smallman Street Reconstruction did not start until 2018.

a(iii) Maytide Storm and Sanitary Sewer System Improvements did not start until 2018.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-9 Reference Section 3.4: Initial Planned Repair and Replacement Schedule and Projected Annual Expenditures

a. Provide a table or tables that detail(s) PWSA's historic replacement of the DSIC-eligible materials by year for each of the years 2013 through 2017 for each of the identified major project categories:
   i. Small-Diameter Sewer Rehab
   ii. Large-Diameter Sewer Rehab
   iii. Sewer Reconstruction
   iv. Sewers Under Structures

Response:

Project Type	2014	2015	2016	2017
Large Diameter Sewer Rehabilitation	$ 3,005.33	$ 1,110,793.88	$ 1,261.15	$ -
Small Diameter Sewer Rehabilitation	$ -	$ 1,007,599.37	$ 49,470.94	$ 1,278,119.66
Sewer Reconstruction	$ 233,718.52	$ 1,942,653.53	$ 1,241,475.39	$ 1,198,329.21
Water Relay and Sewer Reconstruction	$ 963,698.00	$ 813,811.37	$ 56,968.11	$ -

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-8 PWSA indicates that it will develop a computerized work order maintenance system to improve the management of day-to-day maintenance of the system and emergent needs during water main breaks. When does PWSA anticipate having this system in place?

Response:

PWSA has developed a general scope of the project work to implement a Computerized Maintenance Management System (CMMS), and has previously received proposals for this work. Despite awarding a contract, the CMMS project has never been started. Much of the CMMS requirements will be related to the Operations Assets, which have yet to be fully documented, including past work order activities. The data required to fully implement the CMMS system will not be completely reduced from paper copy to digital format for about 24 months. Once that data conversion is completed, PWSA will implement the CMMS system for Operations and Engineering users.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-7 Reference Section 2.5: Initial Planned Repair and Replacement Schedule and Projected Annual Expenditures

a. Provide a table or tables that detail(s) PWSA's historic replacement of the DSIC-eligible materials by year for each of the years 2013 through 2017 for each of the identified major project categories:
   i. Hydrant Replacement
   ii. Valve Replacement
   iii. Water Relay Replacement
   iv. Small Diameter Water Main Replacement
   v. Large Diameter Water Main Improvements
   vi. Large Water Meters
   vii. Lead Service Line Replacement

Response:

Project Type	2014	2015	2016	2017
Water Relay and Sewer Reconstruction	$ 963,698.00	$ 813,811.37	$ 56,968.11	$ -
Large Diameter Water Main Improvements	$ 730,072.16	$ 1,312,640.70	$ 1,520.95	$ 2,274,876.49
Small Diameter Water Main Replacement	$ 560,165.53	$ 4,849,606.41	$ 3,702,611.40	$ 1,473,964.46
Water Relay Replacement	$ -	$ 23,748.87	$ 654,902.88	$ 1,590,283.15
Valve and Hydrant Replacement	$ -	$ 2,802,787.48	$ 1,079,207.42	$ 829,307.67
Lead Service Line Replacement	$ -	$ -	$ -	$ 1,678,084.92
Large Water Meters	$ 532,637.37	$ 239,267.32	$ 35,198.00	$ 400,216.66
Small Water Meters	$ 91,847.04	$ 812,132.66	$ 301,433.30	$ -

Response provided by: Robert A. Weimar, Executive Director, PWSA

Exhibit RAW/C-2

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-6 Reference Section 2.3.5: Annual Hydrant and Valve Replacement Program

a. Does the projected rate of replaced hydrants (1% per year for 2018 and 2019) include only those inoperable hydrants identified during routine maintenance and flushing activities and/or reported through fire departments?
b. If not included in the annual contract replacements, how many hydrants are expected to be replaced through water main replacement projects through the course of the LTIIP?
c. How many hydrants will be replaced per year for the rest of the term of the LTIIP?
d. How many valves 12 inches and larger are expected to be replaced each year of the term of the LTIIP?
e. When will the valve database be completed?

Response:

a. Yes. In addition, inoperable valves identified during emergency main break repairs are also included in the annual replacement program.

b. The only water main replacement locations currently identified are included in the 2018/19 replacement program. The LTIIP includes main replacements over a 5-year period. It is PWSA's plan to clearly map out a formal program of water main replacements through the water system master plan which will be completed in 2019. This plan will allow a more detailed assessment of the number of valves and hydrants that will be replaced over the 5-year LTIIP period. Hydrants are typically located every 500 feet. Therefore, the 2019 SDWMRP expects to replace approximately 31 hydrants, 2020 SDWMRP will replace approximately 85 hydrants, and 2021 SDWMRP will replace approximately 200 hydrants.

c. See comment above. We anticipate that the hydrant replacements during the SDWMRP will average 200 per year, plus those replaced due to damage or inoperable condition.

d. The 2019 Valve Replacement Contract assumes twenty-four 12-inch and larger valves to be replaced. The 2020 and thereafter program will be dependent upon an updated valve assessment program.

e. It is anticipated that the valve database will be updated within **24 months.**

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-5 Reference Section 2.3.1: 2018 Small Diameter Water Main Replacement Program

a. Provide clarification and/or additional detail to support PWSA's chosen 2018 SDWMR projects, such as the main break history of all small diameter mains by location for the past 5 years, identification of locations or areas where available fire flow is constrained by the small diameter mains, and the definition of a "major user" and how those are prioritized.

Response:

The selection for the 2018 SDWMR project was from the same pool of mains used in the 2019 SDWMR project. Therefore, the 2018 SDWMR did not look at the break history of all small diameter mains by location for the past five years, but only those that were in the existing pool of mains identified for replacement. A "major user" is considered to be critical risk users such as hospitals, schools, nursing homes, etc.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-4 Reference Section 2.2: Lead Service Line Replacement Program; and Appendix C

a. As outlined in the PWSA Lead Policy, the policy addresses only single-family residential properties with service lines of 1-inch diameter or less. What is PWSA's program, if any, for non-residential service lines of 1-inch or greater as well as other lead facilities on the PWSA system?

Response:

Should any lead service lines greater than one inch in diameter that are connected to a single family residence be discovered, PWSA would replace these pipes with a suitable sized line. Should a large diameter lead service line be found to serve residences, suitably sized individual lines would then be installed. Historically, it is rare for lines over one inch in diameter to be made of lead. Commercial customer lines are greater than one inch in diameter and the customer owns the service line from the main to the meter, so there is no portion of that line that PWSA owns or is likely to be lead.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-3 Reference Section 2: Water System

a. PWSA's prioritization of water main and service line replacement projects, other than lead service lines, appears based on several factors that do not include the material type of the mains and lines. Describe in detail if material type was utilized in the evaluation process for the small diameter main, water main, and large diameter main replacement programs. If material type was not a factor utilized in the evaluation process, describe in detail why not.

Response:

PWSA is able to use pipe age as a substitute for pipe material at this time. For the small diameter mains, unlined cast iron was typically used pre-1900 to mid-1940s. Cement-lined cast iron was used from the mid-1940s to early 1970s. Cement-lined ductile iron was used from early 1970s to present. These material timeframes can generally also be used for the large diameter mains, but PWSA knows the pipe material for the majority of the large diameter mains (36-inch and larger). The largest mains, the rising and supply mains, are typically riveted steel mains for mains 50" and larger. These mains were cement lined in the 60s and 70s. There are a handful of PCCP mains. PWSA's current small diameter water main replacement program (2018/19) were developed to replace undersize mains (smaller than 6-inch diameter) and improve fire flows and water quality. Going forward, PWSA is proposing a more formalized approach to identifying water main rehabilitation/replacement as outlined in the LTIIP. While not specifically mentioned, pipe material is a critical element in the evaluation process and has a direct impact on main break history and water quality and fire flows. Unlined cast iron and steel pipes make them much more susceptible to corrosion than lined ductile iron pipe or HDPE and PVC materials. PCCP has its own issues relative to corrosion and degradation of internal pre-stressing wires. The intent is to include pipe material into the overall pipe evaluation program. This prioritization program will be formalized in the water and sewer master plans which will be completed in 2019.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-2 Reference Figure 2-3: Water Valves by Type

a. Describe in detail what is meant by "...the 'valve type' field in the Authority's GIS system is undergoing verification and reevaluation."

b. When will the "verification and reevaluation" be completed?

c. Confirm if the verification and reevaluation will revise any of the Tables or Figures presented in the LTIIP and, if so, provide a timeline when the updated information will be submitted.

Response:

a. The valve type is whether the valve is a gate valve, butterfly valve, boundary separation valve, hydrant connection valve, etc. These types of valves are accurately depicted in the GIS. However, air release valves, air/vacuum valves, and pressure relief valves are not labeled consistently the same in the GIS. Additional work is required to verify the type of air valve and size.

b. The updating of the GIS is an on-going process. PWSA has hired additional GIS technicians to assist with this process. In addition, PWSA will be undertaking a GIS updating program which involves the scanning of paper maps and records and then inputting this information, if not already in GIS into the mapping database. It is anticipated that this GIS update will be completed in about 24 months.

c. It is expected that there may be some modifications to the data contained in the Tables presented in the report once the GIS is updated. It is anticipated that updated information can be made available in about 24 months.

Response provided by: Robert A. Weimar, Executive Director, PWSA

Response of Pittsburgh Water and Sewer Authority
to TUS Data Requests, Set I in
Docket Nos. P-2018-3005037 and P-2018-3005039 (LTIIP)

Reference PWSA's LTIIP

Request: TUS-I-13 Reference Section 8: Outreach and Coordination Activities

a. Describe specifically how PWSA will engage with local utilities and governments to coordinate its expanded capital spending projected in the LTIIP including how PWSA will coordinate with local utilities and governments for increased capital spending through 2023 when overlapping projects make such coordination desirable.

b. Indicate if PWSA participates in the Pittsburgh Public Service Coordination Committee.

Response:

a. PWSA has an on-going outreach program working directly with the City of Pittsburgh, other municipalities (if applicable), the PennDOT and local utilities to coordinate on-going and upcoming capital improvement projects. The goal is to ensure projects occurring in the same roadways are being coordinated with the City and State road reconstruction and paving programs in order to reduce the cost of surface restoration and impacts on the local communities. At present, PWSA attends construction coordination meetings with the City Department of Mobility and Infrastructure. These meetings allow general coordination of ongoing activities. However, the current coordination typically only addresses projects that are predicted for each upcoming year, and do not include a long term look ahead.

Once PWSA completes its water and sewer master planning, and long-range capital projects are more clearly defined down to the local street level, the CIP projects can be input into PWSA's GIS and shared with the various stakeholders to enhance the collaboration and coordination efforts. Having this level of detail in the future will allow PWSA to actively prioritize projects as much as 3 years ahead in collaboration with other utility rehabilitation and replacement work. This level of granularity will also allow PWSA to internally coordinate its replacement work between water main replacements, and sanitary and stormwater upgrade projects so that work can be completed in areas at one time, minimizing impacts on the public and reducing surface restoration costs.

b. The Pittsburgh Public Service Coordination Committee is an offshoot of the PUC, PA One Call organization. PWSA has met recently with PUC staff and Commissioner Coleman to implement a comprehensive coordination program which will bring a higher level of project planning to ensure that its combined ratepayers can reap lower rates from our collective coordinated efforts. PWSA is committed to a comprehensive coordination effort and intends to support these programs with data and staff to the greatest extent possible.

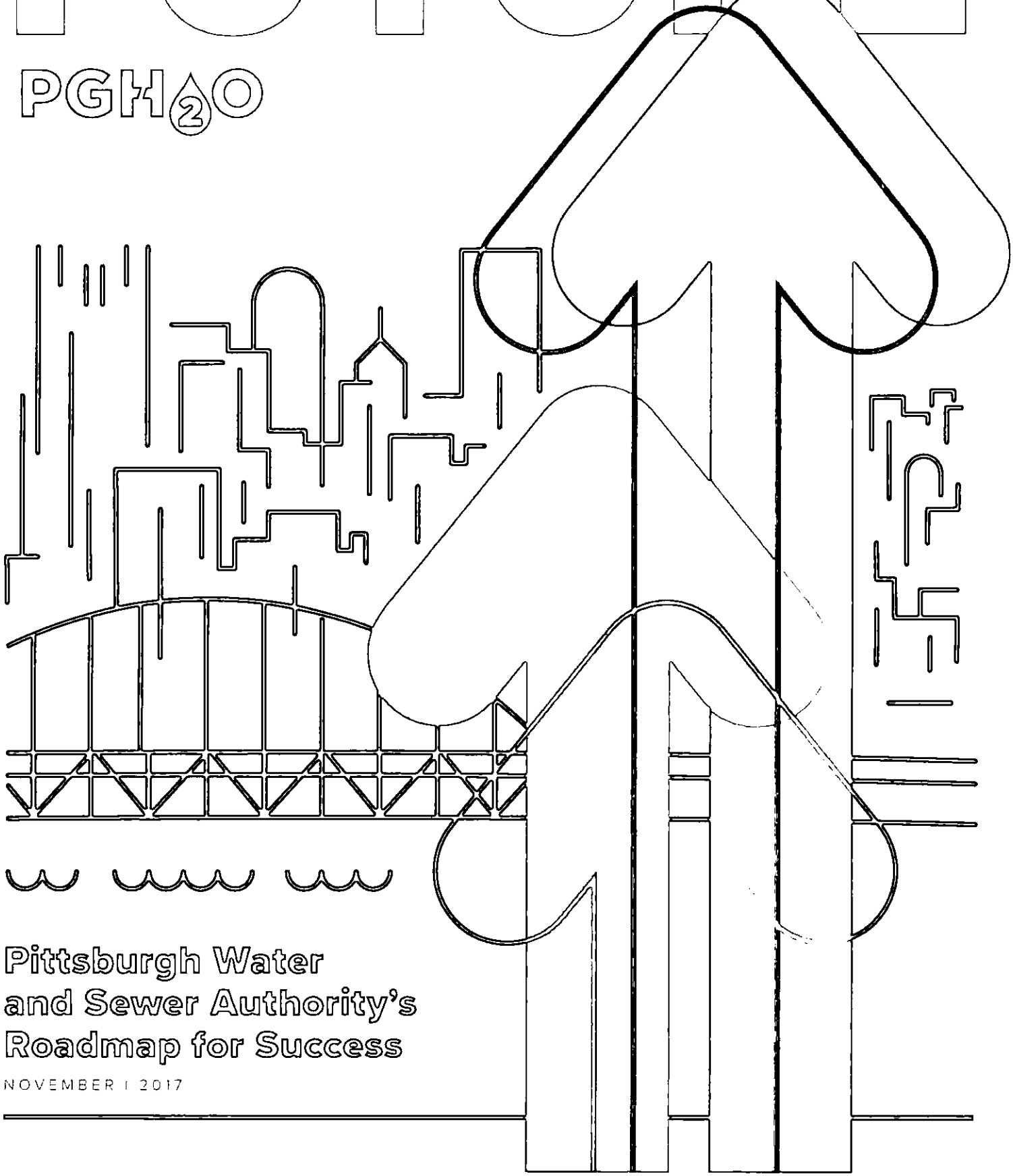
Response provided by: Robert A. Weimar, Executive Director, PWSA

FOCUSING ON THE

Exh RAW/C-3

FUTURE

PGH2O



Pittsburgh Water and Sewer Authority's Roadmap for Success

NOVEMBER | 2017

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Message from the Executive Director:

The people of Pittsburgh have enjoyed access to public water service for more than 200 years. Today, that service is provided by the Pittsburgh Water and Sewer Authority (PWSA), which exists to support the community's vitality by protecting public health and the environment through safe, reliable, and cost-effective delivery of water, wastewater conveyance, and stormwater services.

PWSA's challenges are well defined; but they are neither unique, nor insurmountable. Extended periods of underinvestment and organizational instability have led to infrastructure failures, regulatory lapses, and organizational turnover. These are common challenges that most urban water systems in the northeast face. Through a combination of new and existing initiatives, talented leadership, and a supportive Board of Directors, PWSA is committed to improving its operations and addressing these challenges.

PWSA has a solid foundation to build upon – an ample water supply from the Allegheny River, adequate delivery capacity throughout its distribution system, and a stable customer base. This Organizational and Compliance Plan builds on the utility's strength. It articulates PWSA's goals, the concrete actions that will be taken to achieve those goals, and the measures by which PWSA staff, outside stakeholders, and customers can measure its ultimate success.

With this plan – and hard work – we will be successful. We will continue working, every day, to deliver safe, reliable, and cost-effective drinking water, wastewater conveyance, and stormwater services. We will continue working, every day, to protect public health and the environment. And we will continue working, every day, to be a highly responsive and trusted public utility, recognized for excellence and valued by our community.

Pittsburgh deserves no less.

Robert Weimar, P.E.
Interim Executive Director
Pittsburgh Water and Sewer Authority

WHAT IS OUR FUTURE?

PWSA is a highly responsive and trusted public utility, recognized for excellence and valued by our community.

WHAT DO WE DO?

PWSA supports community vitality by protecting public health and the environment through safe, reliable and cost-effective delivery of drinking water, wastewater and stormwater services.

OUR GOALS



Protect Public Health and the Environment

To protect and support the long-term health of our community and environment



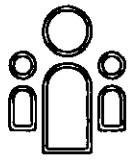
Ensure Customer and Stakeholder Satisfaction

To enhance customer and stakeholder confidence by communicating effectively and engaging our community



Improve Infrastructure Reliability

To ensure service reliability through responsible infrastructure investment and proactive maintenance



Maintain a High-Performing Workforce

To recruit, develop, and retain a motivated and well-qualified team



Be an Efficient and Effective Organization

To optimize the use of our resources through innovative technology, effective processes, and continuous improvement

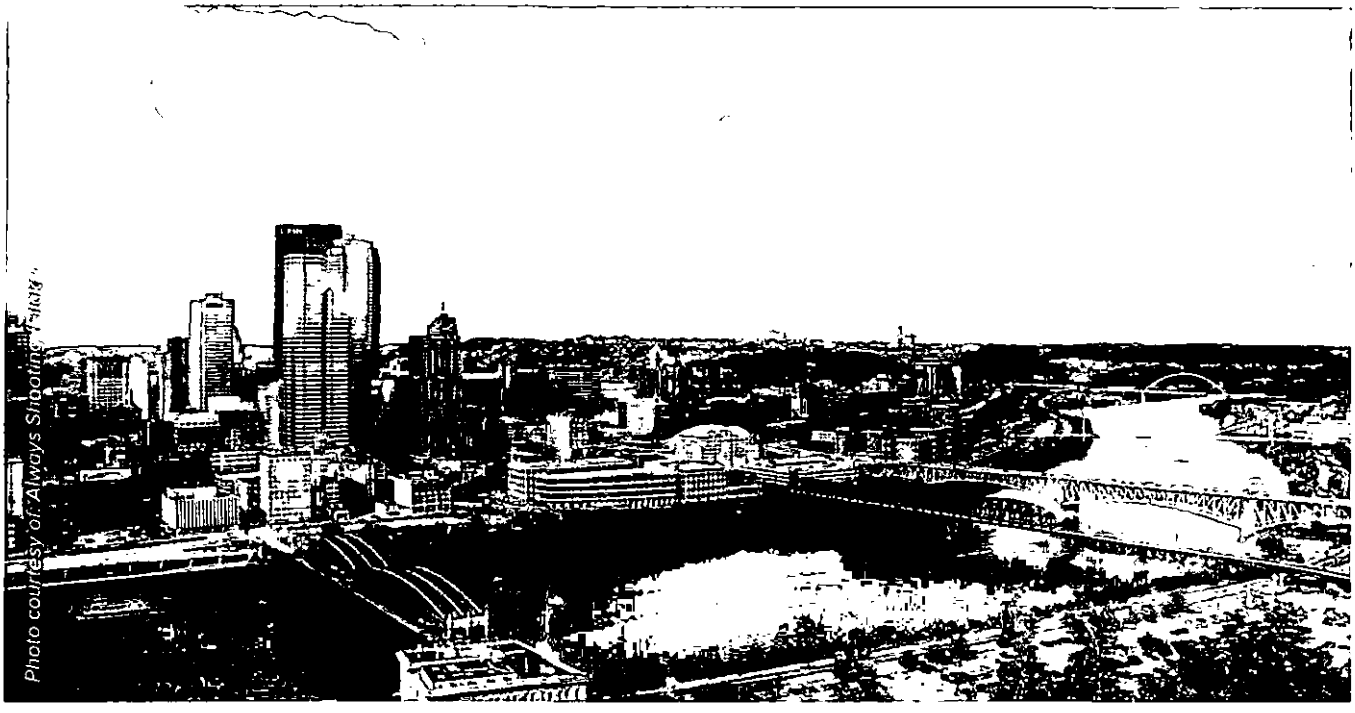


Photo courtesy of Always Shooting

increased utility financial constraints, regulations, workforce issues, and customer expectations.

TREN

This Organizational and Compliance Plan addresses these trends.

TREND 1:
CUSTOMER EXPECTATIONS

Changing requirements for service delivery are being driven by a new generation of customers who expect more rapid and easy access to information. The customers of the future are driving the investments of today.

PWSA must respond by providing updated customer billing and information management systems that meet the expectations of a changing customer base.

TREND 2:
FINANCIAL CONSTRAINTS

With capital and operating budgets rising, and stakeholder groups who are increasingly resistant to rate increases, utilities struggle to make necessary investments.

PWSA carries a significant debt load of more than $840 million, and additional capital investment is needed. Rates are expected to rise over the next several years as we replace our aging infrastructure and strengthen our delivery of services.

TREND 3:
REGULATIONS

Across the board, regulations are becoming more stringent, which requires greater investment of an organization's scarce resources. Compliance with environmental regulations tends to be especially challenging (and costly).

In 2008, the Pittsburgh region entered a Consent Decree with the US Environmental Protection Agency to reduce and eliminate sewage contamination in local streams and rivers. The Consent Decree requires all 83 communities within the regional service area to repair broken sewer lines, reduce storm water entering the system, reduce the frequency and amount of combined sewer overflows, and eliminate sanitary sewer overflows.

TREND 4:
WORKFORCE ISSUES

Water-sector utilities struggle to recruit and retain staff with the necessary skills and competencies to manage utility operations. Typically, utilities have aging workforces, which make knowledge retention and succession planning significant challenges.

PWSA has experienced frequent leadership turnover in the last several years, and operates in a union environment, which can limit workforce flexibility. Compensation is limited, and often not competitive as compared to the private sector. Additionally, the utility's financial constraints have curtailed some employee development and training opportunities.

DS

GOAL 1

To protect and support the long-term health of our community and environment

The primary mission of any water and wastewater utility is to protect public health and the environment. Drinking water must meet all regulatory water quality requirements when it leaves PWSA treatment facilities and when it is used at a customer's tap. PWSA must ensure that wastewater is collected from customers without backups or spills, and conveyed through the wastewater collection system to the regional ALCOSAN treatment facility. The conveyance process must be secure, and occur without sanitary sewer overflows (SSOs) that could damage the environment. Treatment then renders the wastewater safe, before it is discharged back to the environment.

FOCUS AREA 1:

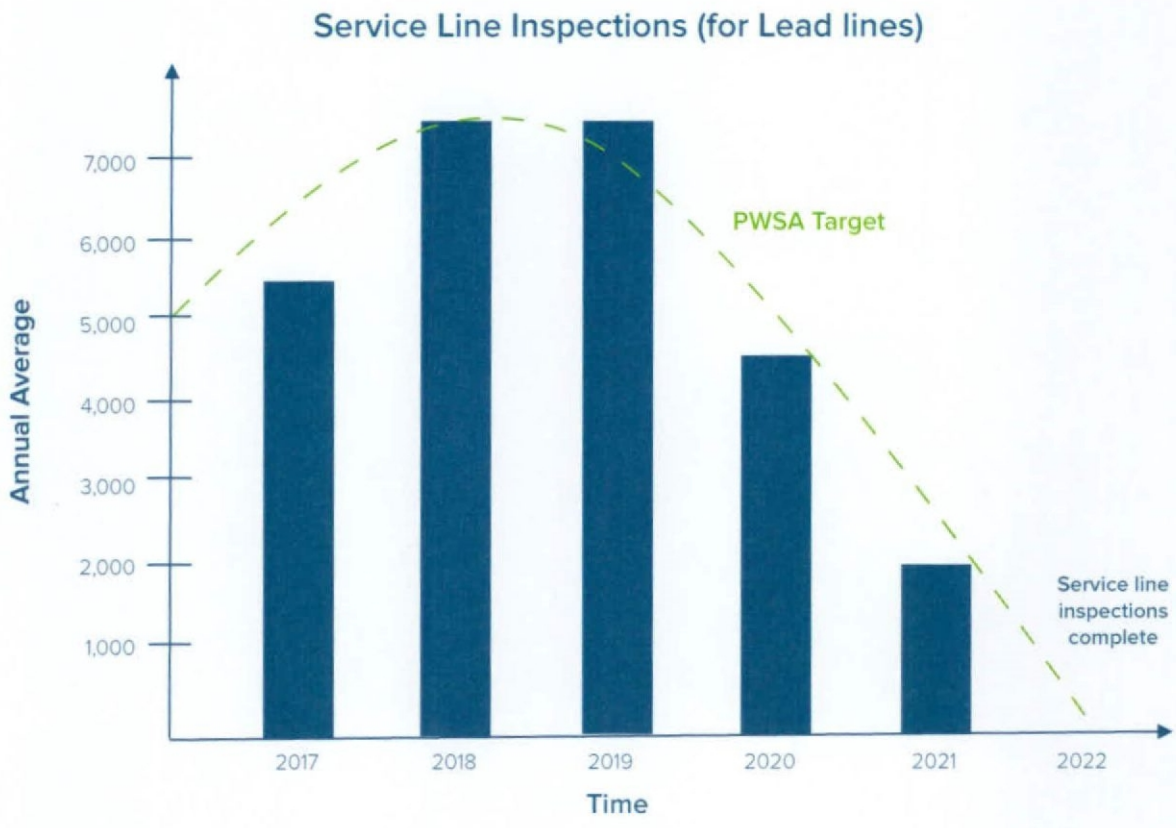
DELIVER HIGH QUALITY DRINKING WATER

Our goal is to continuously meet or exceed customer and regulatory standards for the water that we provide. To do that, PWSA will pursue the following strategies:

- Perform regular tests at certified laboratories to ensure high water quality and service levels
- Report water quality results to customers in an annual Consumer Confidence Report
- Continue to actively manage and replace lead service lines

Ensuring success in this area will require PWSA to effectively manage its distribution system, including increasing the number of water quality monitoring points; regularly flushing the system; incorporating best-in-class technology and enhanced modeling capabilities; and improving its cross-connection control program to meet industry best practices.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Compliance with regulatory water quality standards	→	365 days of full water quality compliance
Implement cross-connection control	→	• 100% of service connections rated for potential threat level and catalogued • All backflow devices tested at regular intervals
Compliance with lead standards	→	Lead levels in compliance with EPA standards
Achieve water pressure standards	→	Meet target maximum and minimum pressure in water mains; minimum fire flow at hydrants



FOCUS AREA 2:

SAFELY AND EFFECTIVELY CONVEY WASTEWATER AND STORMWATER

Our goal is to continuously meet or exceed customer and regulatory standards as we convey wastewater and stormwater to the ALCOSAN treatment facility. PWSA is committed to:

- Maintaining wastewater system cleaning, root removal, and maintenance activity to prevent back-ups
- Routinely inspecting manholes
- Monitoring and reporting on all combined and sanitary sewer overflows
- Regularly performing condition assessments on all gravity pipe segments

PWSA's continued success in this area will also require implementing a risk-based wastewater system renewal program; incorporating similar best-in-class technology and modeling capability to what is required for the water system; and adopting a lateral inspection and renewal program.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Compliance with regulatory wastewater and stormwater quality standards	→	365 days of full compliance
Eliminate sanitary sewer overflows (SSOs)	→	Zero SSOs per year
Compliance with combined sewer overflow (CSO) requirements	→	Reduced number and volume of CSOs
Minimize back-ups and failures	→	Fewer than one unplanned failure per 5,000 accounts (AWWA benchmark)
Clean and inspect wastewater mains and manholes	→	10% of system annually

GOAL 2

To recruit, develop, and retain a motivated and well-qualified team

Attracting, training, and developing the next generation of utility staff is quickly becoming a significant focus area for every major water utility. A high-performing organization needs to address capturing and transferring institutional knowledge, succession planning, career development and personal growth opportunities for its workforce. Training and incentives that enhance and recognize employee efforts provide the means to establish higher standards to meet the needs of modern utility operations. PWSA's shift to a learning-based culture will help attract and support a high-performing workforce.

FOCUS AREA 1:

INCREASE HIRING EFFECTIVENESS

Developing a strong workforce relies on identifying and hiring qualified applicants. To that end, PWSA is committed to:

- Implementing a new Human Resources Information System (HRIS)
- Reviewing and improving job postings and position descriptions
- Optimizing and streamlining the hiring process and timeline
- Reviewing employee total compensation packages

Additionally, PWSA will look to extend outreach to industry publications, community partnerships, and other venues to reach prospective talent; as well as evaluating the possibility of eliminating the City's domicile employment requirements that hinder finding and retaining good people.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Hiring Response Time	→	Average time to fill existing positions is less than three months from the date of the vacancy
Position Vacancy Rate	→	Average vacancy rate is less than 3%



Photo Courtesy of Tony Webster (Flickr)

FOCUS AREA 2:

ENHANCE WORKFORCE ENGAGEMENT AND PERFORMANCE

Increasing the efficiency and effectiveness of our organization requires engaged, developed, and high-performing PWSA employees. Creating this workforce will require PWSA to:

- Work cooperatively with unions to find and act on opportunities to increase workforce performance and effectiveness
- Complete a training program roadmap and inventory of the training requirements for all positions at PWSA
- Dedicate additional resources to training and development; as well as health, safety, and risk management
- Establish and track productivity goals for work groups, where applicable

Additionally, PWSA will develop a program to recognize high-performing employees and will support employee involvement in industry groups and events.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Training hours per year	→	Twenty hours per employee per year
Safety Compliance	→	Maintain a workers' compensation experience modification rate of less than 1.0
OSHA Compliance	→	Meet OSHA requirements
Conduct a staff engagement survey every three years	→	Increased engagement levels

GOAL 3

To enhance customer and stakeholder confidence by communicating effectively and engaging our community

PWSA is committed to maintaining an elevated level of quality, performance, and value. While the utility has recently experienced infrastructure failures, billing issues, and negative media reports, PWSA is actively working to regain community confidence. Recognizing that the utility must earn customers' support and trust, PWSA has already begun to engage the community and communicate many of the positive changes that are being made to enhance service.

FOCUS AREA 1:

RESPOND TO CUSTOMERS AND STAKEHOLDERS IN A TIMELY MANNER

Being responsive to customers is paramount to earning their trust and recognition of PWSA as a valuable community resource. To do that, PWSA will:

- Develop Standard Operating Procedures (SOPs) and standard scripts for effectively managing common types of customer contacts
- Provide customer service staff with additional training and call monitoring
- Increase call center resources to meet call volumes and achieve target performance goals

MEASURE OF SUCCESS		TARGET PERFORMANCE
Less than 5% of calls abandoned	→	Average answer speed of less than three minutes
Reduce call abandonment	→	Less than 3% of calls abandoned
Minimize customer complaints	→	Less than 5.9 complaints per 1,000 accounts annually

FOCUS AREA 2:

REGULARLY PROVIDE CLEAR AND EFFECTIVE INFORMATION

Customer and stakeholder support and trust begin with understanding, and that begins with the information that PWSA shares. PWSA is committed to:

- Developing a communications plan, to include social media and web-based strategies
- Increasing transparency and developing educational materials
- Providing regular progress reports to key PWSA stakeholders

MEASURE OF SUCCESS		TARGET PERFORMANCE
Conduct an annual customer and stakeholder satisfaction survey	→	Increased satisfaction rates
Increase social media interaction	→	Increased platforms, followers, and engagement

---

FOCUS AREA 3:

UTILIZE ADVANCED METER INFRASTRUCTURE (AMI) TO GENERATE ACCURATE CUSTOMER BILLS

Ensuring customer satisfaction, as well as utility revenue sufficiency, relies on PWSA's ability to accurately read meters and generate the corresponding bills. This requires PWSA to:

- Meter all users, including public and commercial users
- Verify AMI and CIS communications to ensure accurate data transfers
- Adopt industry best practices for billing quality control and assurance
- Adopt AWWA Water Loss Management Practices

Additionally, PWSA will maintain a robust meter monitoring, testing, and replacement program; ensure all meters are connected to the AMI system; conduct leak detection analysis; and alter the printed bill layout to ensure that it is easily understandable.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Percent of accounts metered within 18 months	→	100% of active, permanent accounts metered
Equip all meters with AMI technology	→	98% of active, permanent meters have AMI technology
Ensure accurate meters	→	95% of residential and 98% of commercial meters meet minimum acceptable accuracy levels (any over-billed accounts are adjusted promptly)
Provide timely and accurate bills to customers	→	99.9% of bills are sent on time with no errors in charges fees
Minimize non-revenue water	→	Reduce non-revenue water to less than 20% of treated volume

GOAL 4

To ensure service reliability through responsible infrastructure investment and proactive maintenance

PWSA operates and maintains over 2,000 miles of water and sewer pipe, two water treatment plants, and numerous water storage reservoirs, pumps stations, manholes, and fire hydrants. Unfortunately, most assets are underground and hidden from view, so problems with these important networks often goes unnoticed until failures occur. This has led to decades of underinvestment. PWSA is dedicated to investing the necessary resources to elevate the condition of its infrastructure and minimize system failures.

FOCUS AREA 1:

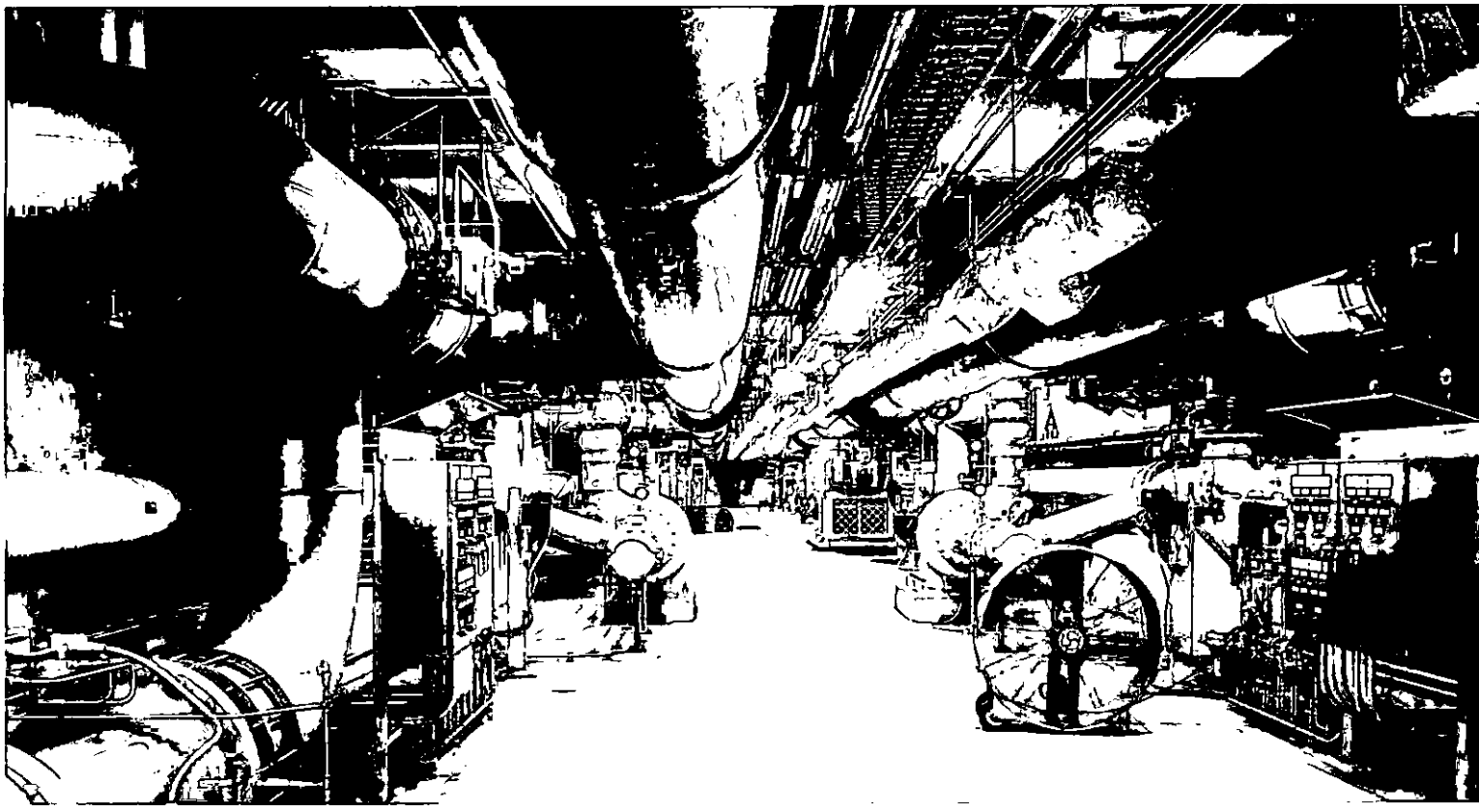
IMPLEMENT ENHANCED MAINTENANCE PRACTICES

Enhanced maintenance practices will allow PWSA to extend the useful life of its assets and reduce costs over time. Doing so requires PWSA to:

- Inspect and rate the condition of gravity pipe segments on a regular schedule
- Add additional crews to implement and maintain a 2-year cycle of valve and hydrant exercising
- Increase field crew productivity

PWSA will need to focus on increasing the ratio of proactive to reactive maintenance; shift to replacing infrastructure based on risk and performance, rather than years in service; and fully integrate capital project and maintenance management technology systems.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Increase the number of proactive work orders	→	80% of work orders are proactive
Perform manhole inspections	→	20% of manholes are inspected annually
Conduct condition assessment of wastewater mains using CCTV	→	15% of the wastewater collection system to be assessed annually



FOCUS AREA 2:

RENEW AGING/FAILING INFRASTRUCTURE

PWSA's success in achieving its mission and accomplishing its goals relies heavily on the condition and sufficiency of its infrastructure. Continuing to focus on developing and maintaining that infrastructure to meet customer needs now and into the future will occur by:

- Implementing and staffing the internal Project Management capability necessary to oversee and manage capital projects
- Ensuring sufficient resources to align capital renewal with the desired service levels

Renewing aging/failing infrastructure will require development of installation and repair SOPs; implementing a risk-based renewal system; adopting a lateral inspection and renewal plan; and initiating the water loss programs discussed in the previous section.

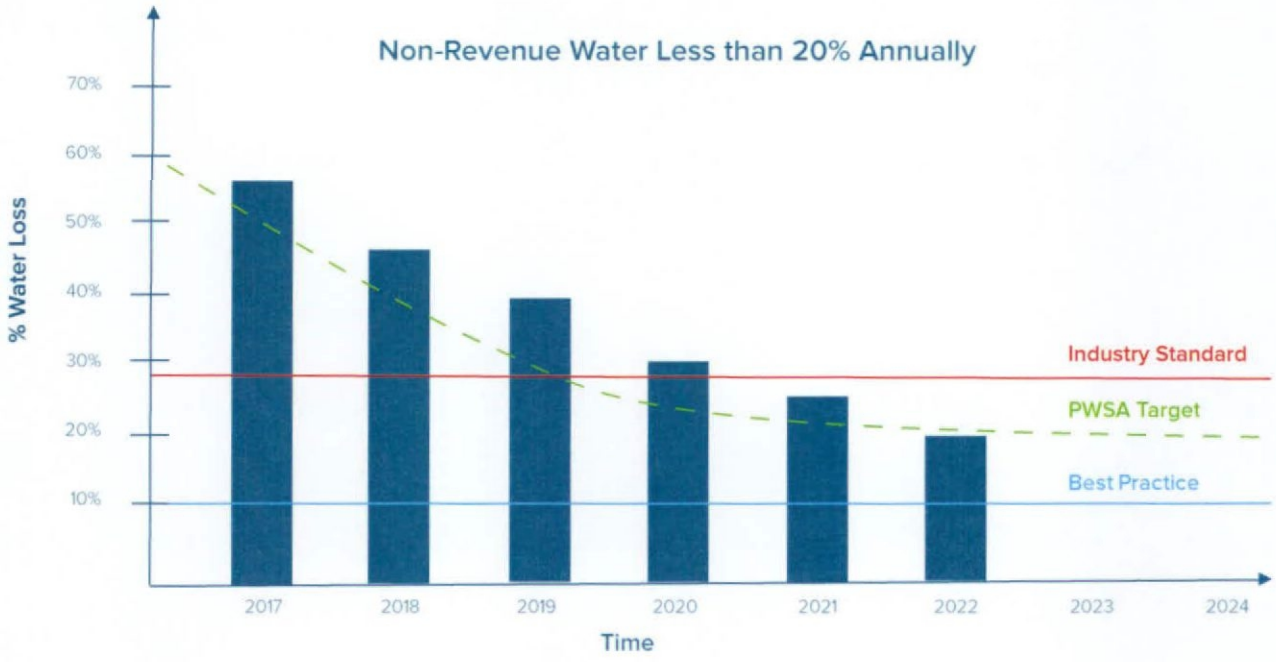
MEASURE OF SUCCESS		TARGET PERFORMANCE
Replace/rehabilitate buried assets at an accelerated rate	→	Renew at least 2% of buried assets per year
Reduce water main breaks	→	Achieve a failure rate of less than 50 breaks per 100 miles of water main annually
Ensure the financial resources are available to implement the capital plan	→	Acceptance and approval of user charges to fully fund CIP

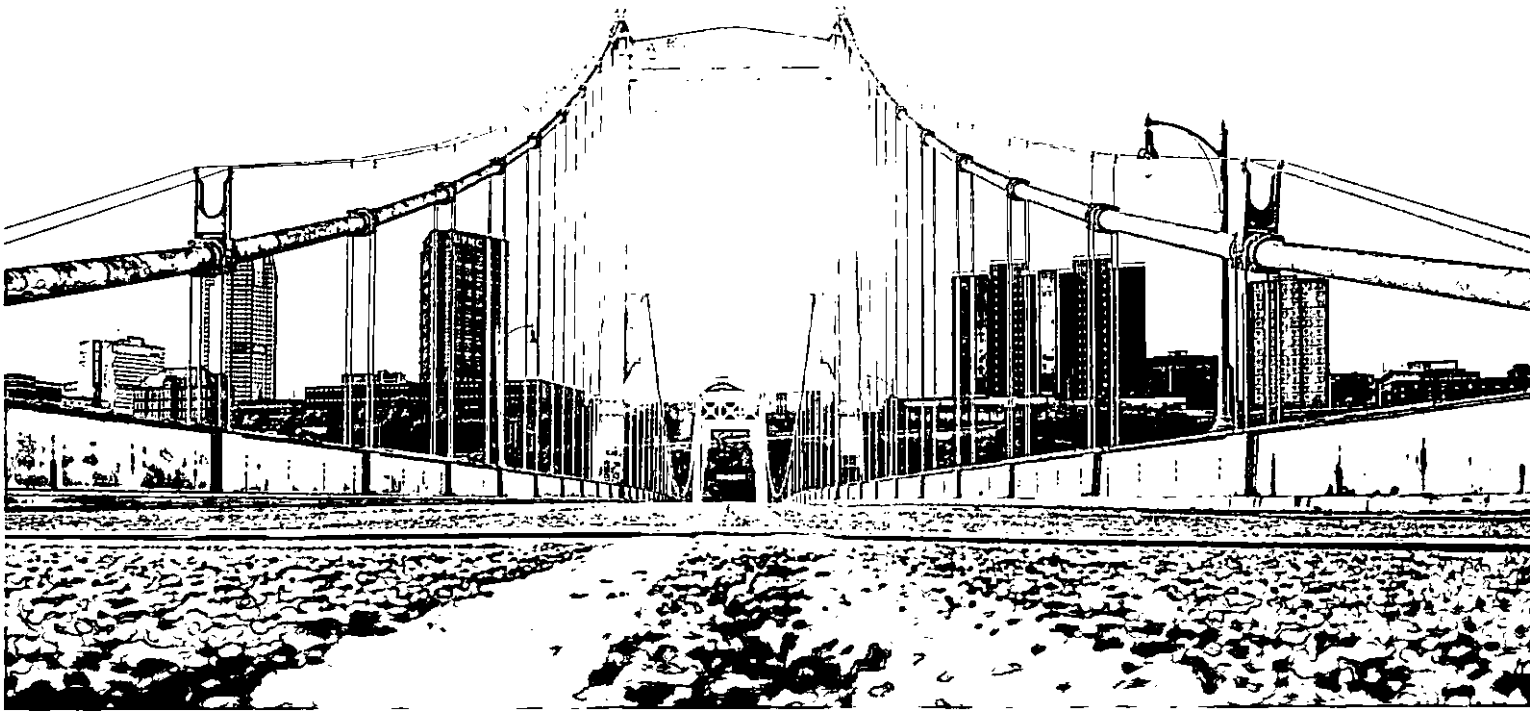
GOAL 5

BE AN EFFICIENT AND EFFECTIVE ORGANIZATION

To optimize the use of our resources through innovative technology, effective processes, and continuous improvement

The people of Pittsburgh expect PWSA to provide excellent value, spending the public's money and using its resources as efficiently and effectively as possible to ensure the delivery of high quality services. To meet these expectations, PWSA will increase its productivity and streamline its systems and processes. Ultimately, PWSA is focused on instituting better practices, implementing modern technologies, and using data to drive improvements to organizational performance. These changes will allow us to continue to provide the high-quality and timely services our customers deserve.





FOCUS AREA 1:

IMPLEMENT ENHANCED WORK PRACTICES AND STANDARDS

Increasing the efficiency and effectiveness of our organization starts with instilling a culture of continuous improvement in PWSA employees. This will allow us to look critically at our existing operations, use data to identify key areas for improvement, implement change, and measure success. Specifically, PWSA will:

- Establish a Performance Improvement group to help instill and grow a culture of continuous improvement
- Adopt technologies and reporting processes to seamlessly communicate progress in key performance areas
- Use a combination of internal and external resources to address critical staffing needs

Particular areas of opportunity include centralizing the field work yards and the warehouse; optimizing the use of fleet and vehicle assets; and implementing an operations technical support function to focus on treatment optimization and process control.

MEASURE OF SUCCESS		TARGET PERFORMANCE
[illegible]	→	[illegible]
[illegible]	→	[illegible]
[illegible]	→	[illegible]
[illegible]	→	[illegible]

GOAL 5: BE AN EFFICIENT AND EFFECTIVE ORGANIZATION

FOCUS AREA 2:

INVEST IN INFORMATION TECHNOLOGY SYSTEMS AND RESOURCES

Our goal is to enhance our organization's performance through the implementation of modern technology, which will support the work practices and standards described in Focus Area 1. To achieve this goal, PWSA will:

- Implement robust IT systems that allow for increased levels of service and the elimination of paper-based recordkeeping. These systems include a computerized maintenance management system (CMMS), a Human Resources Information System (HRIS), and an updated Customer Information System (CIS).
- Increase IT resources to support security, programming, database administration, and desktop support

Additionally, PWSA is focused on increasing its use of business analytics, GIS integration, and use of an electronic document management system.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Procure and begin CMMS Implementation	→	6 months to procure and 1 year to fully implement
Procure and begin CIS Implementation	→	8 months to procure and 2 years to fully implement
Procure and begin HRIS Implementation	→	8 months to procure and 1 year to fully implement

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FOCUS AREA 3:

MAINTAIN FINANCIAL INTEGRITY

Our goal is to consistently meet or exceed targeted financial metrics while delivering clean, safe, and reliable service to customers at rates they can afford. To do that, PWSA will:

- Establish and maintain revenue sufficiency to meet increasing levels of operating and capital costs
- Implement cost-justified rates that are consistent with industry best practices
- Report the results of operations annually in a Comprehensive Annual Financial Report
- Implement an affordability program to provide customer assistance

Ensuring success in the financial focus area will require PWSA to establish financial metrics that can be continuously monitored; implement proactive and cost-justified rate increases; enhance the billing process to reduce billing errors; develop an affordability program; and assess the program's impact on system revenues.

MEASURE OF SUCCESS		TARGET PERFORMANCE
Fully fund operating and capital costs	→	Set water and sewer rates at a level that allows for full funding of utility operating and capital costs
Improve PWSA's bond rating	→	Increase debt service coverage above the covenant-required 1.25x and increase liquidity through annual reserve contributions
Maintain equitable and cost-justified rates	→	Implement equitable and defensible water and sewer rates
Maintain a clean or unmodified opinion annually from PWSA external auditors	→	Adhere to GASB and Pennsylvania PUC-endorsed accounting practices



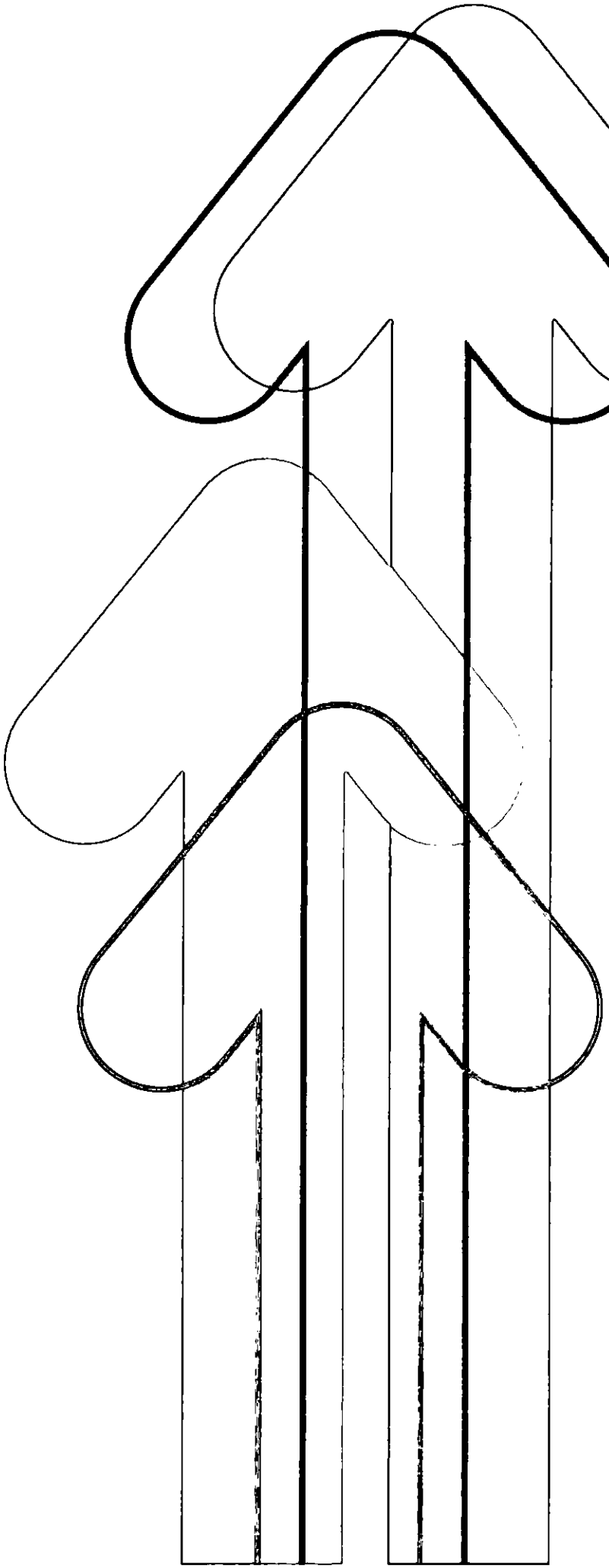
COMMUNICATIONS

Through this Organizational and Compliance Plan, PWSA has committed to improving internal and external communications. Effective communication is critical not only for the successful implementation of the plan, but also for the overall success of PWSA. The issue of communication cuts across the various goals and initiatives discussed herein.

While most specifically called out in the *Ensure Customer and Stakeholder Satisfaction* goal area, PWSA has committed to significantly increasing communications in many areas, through:

- Reporting water quality information to regulatory agencies and the public
- Communication of progress against metrics in key performance areas, both internally and externally
- Production of a Comprehensive Annual Financial Report
- Increased social media and web-based customer and stakeholder interaction
- Creation of community outreach and education materials
- Conducting an annual customer satisfaction survey
- Communication of OSHA and other safety compliance information
- Conducting an employee satisfaction survey every three years

Overall, enhanced communications will be a major initiative at all levels of PWSA to assure employee commitment and to facilitate various teams and individuals working toward the same vision and mission, regardless of which goals or initiatives are their primary focus.



MOVING TO THE FUTURE

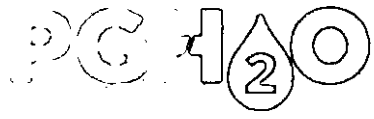
PWSA recognizes that the status quo cannot continue, and that the organization's challenges must be addressed with a sense of urgency. While this Organizational and Compliance Plan has only recently been formalized, many of the initiatives and actions contained within are already underway. A plan alone, however, is not sufficient to address the magnitude of the work that must be completed.

Key hires have already been made, and rates will increase by approximately 28% in FY 2018, which will allow for essential investment in PWSA's critical infrastructure and funding for many of the initiatives included in this plan.

PWSA is also realigning its organizational structure to ensure that sustained progress continues, with the creation of a Strategy and Performance Office. This office will provide needed support in the areas of business process optimization, strategic planning and implementation, and overall performance management. Ultimately, the office will have responsibility for ensuring that PWSA adopts processes and methods to continuously evaluate and improve the organization's operations. Central to this responsibility is the requirement that proven approaches such as LEAN and Six Sigma process improvement analysis methods be deployed as necessary to assist with the organization's overall optimization objectives.

Making progress on the initiatives contained within this plan, continuing to staff key positions with qualified employees, moving toward revenue sufficiency, and reorganizing to support continuous improvement will allow PWSA to achieve its ultimate goal of:

Supporting community vitality by protecting public health and the environment through safe, reliable and cost-effective delivery of drinking water, wastewater, and stormwater services.



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Report of the Mayor's Blue Ribbon Panel

Restructuring the Pittsburgh Water and Sewer Authority

December 28, 2017

Members of the Blue Ribbon Panel:

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Homewood Children's Village

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Members who are Employees of the City of Pittsburgh

Kevin Acklin, Chief of Staff
Office of the Mayor

Jennifer Presutti, Director
Office of Management and Budget

Lourdes Sanchez-Ridge
Solicitor

Highlights of the Blue Ribbon Panel's Recommendations

The Pittsburgh Water and Sewer Authority (PWSA) should not be privatized at this time, nor should the ownership of the system be transferred from the City. PWSA should remain a municipal authority but it must be thoroughly reorganized to make it independent of elective politics and accountable to and trusted by the public.

> This reorganization should be accomplished by March 31, 2018 through a contract between the City and PWSA.
>
> The reorganization should be made permanent by amending the Municipal Authorities Act.

PWSA has made significant progress in recent months. PWSA, working with its new Board of Directors, must continue to pursue aggressively its transformation into a high-functioning, customer-oriented organization and its plan to repair and replace the existing water supply infrastructure.

INTRODUCTION

Water is, of course, essential; no species can live without it. But, for humans, water also carries cultural and social significance, no doubt in part because of its necessity. In Pittsburgh, water is wrapped up in our very identity. We are the City of Three Rivers. We are the City of Bridges (spanning those rivers). Pittsburgh is the city at the head of the Ohio.

Although few Pittsburghers realize it, our region is blessed with a water supply which is judged to be the most reliably available in the country, an enormous advantage in the competition with other cities for prized employers, talented workers and students. At the same time, however, the infrastructure we use to make our plentiful water drinkable and to deliver it to those who need it is badly dilapidated. And the organization we've created to manage it—the Pittsburgh Water and Sewer Authority—is struggling to overcome the burden of its poor management of the past. It has lost the trust of the public that it serves, and it has become a leading risk factor for the future of Pittsburgh's economic development.

Our water system's non-compliance with limits on lead in drinking water, multiple boil water advisories, several water main breaks and widespread errors in billing, have brought unprecedented public attention to PWSA. Collectively, these system failures and deficiencies have created a sense of crisis, and this is a crisis we must not waste. We must summon the political will to (i) make long-overdue changes in the way PWSA is governed and operates and (ii) invest in our water and sewer infrastructure.

CONTEXT, TERMS OF REFERENCE AND PROCESS

In recognition of the severe challenges faced by the Pittsburgh Water and Sewer Authority, the City of Pittsburgh decided to pursue a possible restructuring of the Authority. The City's Office of Management and Budget, on behalf of the Office of the Mayor, sought proposals from qualified consulting groups to provide advice and recommendations. In March, 2017, the Mayor appointed the Blue Ribbon Panel (BRP) to advise the City on the selection of a consultant and to review and render judgments about the consultant's recommendations.

The Selection of IMG

The BRP held two meetings by conference call in March, 2017 to learn about the context and expectations for the consulting engagement and to discuss the selection process.

On March 31, 2017, the Panel met in a public session at which four consulting groups, selected by the City from 18 proposals, made presentations and answered the Panel's questions. The BRP met via conference call on April 13 to discuss the members' evaluations of the four finalists. Based on that feedback, the City selected Infrastructure Management Group (IMG) and its partners to conduct the restructuring study.

The Evaluation Phase

IMG performed its work from May to November, 2017. The BRP was not involved in IMG's work, but it received status presentations from IMG in public meetings on August 28 and September 12, at which BRP members asked several questions and heard public comments, and a final presentation on November 8, also in a public meeting. Several BRP members also participated in a public workshop held by IMG on November 2.

In addition to its public meetings with IMG, the BRP held lengthy private meetings on October 17 (with IMG), November 8, 21, and 27 and on December 11. These private meetings were the primary mechanism through which the BRP explored the nature of PWSA's problems, digested information from IMG, PWSA and other sources, evaluated the options and reached its conclusions and recommendations.

The BRP made extensive use of email to exchange information and comment on drafts of this report. Individual members and subsets of the BRP met and talked with several stakeholders and experts (See the sources of information section below.)

The Independence of the BRP

The BRP and the Mayor's office recognized that it was essential that the BRP be independent of the City and PWSA. Thus, after the initial selection phase, the BRP members who are City employees (Acklin, Presutti and Sanchez-Ridge) stopped attending meetings of the BRP. Furthermore, they did not have input to or review drafts of this report.

The Mayor also appointed a panel of advisors to the BRP (see Appendix A). Some or all of the advisors attended the BRP's public meetings and the private meeting on November 8. None of the advisors attended the subsequent private meetings and, thus, were not directly involved in the BRP's evaluations or conclusions, or in the drafting of this report. However, their inputs early in the process and their written assessments were very valuable.

This report was produced by the independent members of the BRP and represents the opinions of only those members.

Sources of Information

The BRP used a wide range of sources, both written and oral, to inform its work. Of course, IMG's presentations and reports, especially its "Task 5 report," were the centerpiece and driver of the Panel's work, and PWSA provided very extensive information, much of it generated by requests from the BRP. These and many other sources are detailed in Appendix B.

We call out here two sources which were particularly important in informing the Panel's conclusions and recommendations. A report by Howard Neukrug, Patrick Cairo and Satya Rhodes-Conway provided (as of late November 2017) a timely, independent assessment of the PWSA by a team of very experienced

and knowledgeable water utility experts. A series of meetings with, and a memorandum from Carolyn Duronio from Reed Smith, facilitated by the Allegheny Conference on Community Development, provided valuable background and context for the Panel's recommendations on governance.

EVALUATING THE OPTIONS

IMG identified seven options for restructuring PWSA (see Section V of the "Task 5 Report"). Based on its evaluation of the options using ten criteria (Section VI of the "Task 5 Report), IMG recommended restructuring the PWSA based on "three pillars" (Section VII of the "Task 5 Report").

- Governance: Transfer the ownership of the infrastructure and PWSA's governance and rate-setting responsibilities to a new "Pittsburgh Public Infrastructure Trust."

- Operations: Operational reform featured in a contract among the new Public Trust, PWSA and an infrastructure management partner (described next).

- Infrastructure: Enter into a long-term asset management lease assignment with a private partner

The BRP analyzed and discussed these recommendations in great detail, but, rather than restrict our attention to IMG's recommendations, we decided to consider the full suite of options and to evaluate them with criteria that were a modification of IMG's. This approach made for a more robust set of conclusions and recommendations.

The Options

The BRP considered the options for restructuring PWSA listed in Table 1. These are similar to IMG's options, but there are differences, starting with their "Baseline (Status Quo) Path" which the BRP eliminated. Doing nothing is simply not an option.

The BRP's exploration of the Public Trust idea (option 1a), led to the suggestion that there may be easier ways to accomplish the key governance changes, which led to our development, and ultimately recommendation, of option 1b. The other options differ in minor ways from IMG's, e.g., treating non-water utilities as distinct from water utilities in option 6.

The Criteria

IMG identified the ten criteria listed in Table 2. This is a valuable set of criteria, derived from the IMG team's engagement with the public. However, there are important considerations that are not captured as clearly and explicitly as they should be.

The BRP believes that, after public health and safety, there are four criteria of overarching importance:

Independence from political control
Public accountability
Public trust
Durability

IMG's criteria list captures accountability (but curiously combines it with public health and safety—see criterion 2) and durability, while independence and public trust are not explicitly included.

The BRP did not conduct a quantitative analysis of the options and their performance on the criteria. Rather, we asked ourselves whether the options differed in terms of specific individual criteria. In other words, would environmental protection and compliance be better or worse if, say, PWSA were reorganized as a public trust or owned by a private utility? The answer to this is "no, in general," i.e. the environmental performance of either option could be good or bad, depending on execution, not on organizational structure. This is generally the case for the first seven criteria in Table 2. One could counter-argue, for example, that a publicly-owned utility will be more responsive to, say, ratepayer impact than a privately-owned operation. That may be true, but the BRP felt that the key distinction in this case, would be in public accountability—which is why we treated it as a separate criterion—not ratepayer impact per se.

This reasoning led to the modified list of criteria shown in Table 3. We call them "distinguishing criteria" because these are the criteria on which the various options differ from each other. This does not mean that other criteria, like public health and safety, are unimportant; it only means that every option before us could do well (or poorly) in terms of public health and safety. Indeed, one of our recommendations is that, no matter which option is pursued, it be made very clear, through contracts, bylaws, or statute, that public health and safety are of paramount importance and are the core of the water system operations and mission.

The first four criteria in Table 3 have already been discussed. Employee recruitment and retention, our fifth criterion, are crucial for the future of PWSA. We adopted this as a criterion, incorporating bargaining unit protection (IMG criterion #5), as well as training and skills development, residency requirement and compensation. We included efficiency (#6) in order to capture the expected benefit of options that include private sector providers. Implementablity (#7) is a combination of IMG's criteria 8 and 9 in Table 2 and has legal, financial and political dimensions.

Table 1. The Restructuring Options Considered by the Blue Ribbon Panel

1. Governance Change
    a. Public Trust
    b. Modifications to current authority
2. Internal Improvement with City Oversight
3. Long-term Operations and Maintenance Contract with a private company
4. Infrastructure-only Lease Concession
5. Full Service Lease Concession
6. Transfer ownership to a PUC-regulated, investor-owned, private utility
    a. Non-water
    b. Water

Table 2. IMG's Criteria (from "Task 5 Report," pp. 31-33)

1. Ratepayer Impact
2. Public Health and Safety and Public Accountability
3. Performance Impact Guarantee
4. Environmental Protection and Compliance
5. Labor and Bargaining Unit Protections
6. Green Infrastructure Guarantee
7. Low-Income Household Protection
8. Legal and Financial Feasibility
9. Ease and Speed of Implementation
10. Durability of Change

Table 3. The Blue Ribbon Panel's Distinguishing Criteria

1. Independence
2. Public accountability
3. Public confidence
4. Durability
5. Employee retention and recruitment
6. Efficiency
7. Implementability

Using the criteria in Table 3, the BRP then considered each option and determined on which criteria that option was strongest and on which it was weakest. A summary of our assessment is shown in Table 4. Both options 1a and b stand out in terms of independence, accountably, public confidence and durability. We believe that maintaining the PWSA, but with significant governance changes (1b) would be easier to implement than the public trust (1a). This is discussed more fully in the next section.

All of the alternatives that include some degree of privatization were judged to be weak in terms of accountability and the public's confidence in them. These options would also be difficult or impossible to implement politically, and they have uncertain implications for employees.

This, then was the basis for our conclusions and recommendations, presented in the next section.

Table 4. The Blue Ribbon Panel's Evaluation of the Options in Terms of the Distinguishing Criteria

	1 Indepen-dence	2 Account-able	3 Confi-dence	4 Dur-able	5 Employ -ees	6 Effic-ient	7 Implement -able
1.a. Public Trust	*	*	*	*			X
b. Modified Authority	*	*	*	*			?
2. Internal Improvement	X	X	X	X			*
3. O&M Contract	X	X	X	*	?	*	* (Fast) X (Political)
4. Infrastructure-only Lease		?	X		?	*	* ? (Political)
5. Full Lease		X	X	*	?	*	X (Political)
6.a. Non-water Utility		X	X	*	?	*	X (Political)
b. Water Utility		X	X	*	?	*	X (Political)

* = Stronger

X = Weaker

? = Not Sure

CONCLUSIONS AND RECOMMENDATIONS

While PWSA has made important progress in recent months, changes in governance, organizational competence and culture should be pursued with urgency.

There are many useful ideas in the IMG report, and the Blue Ribbon Panel endorses the overall thrust of them, but the panel has some important refinements for some of IMG's specific recommendations and has reservations about others. We have organized our recommendations by following IMG's "three pillars."

I. Governance

The BRP believes that this is the most important change to be made to position PWSA for success both in the short term and the long term.

PWSA must be politically independent in order for the authority to properly focus on strategic and operational plans that result in delivery of clean and affordable water to the residents of the City of Pittsburgh. PWSA's governance must be changed in a way that makes PWSA independent of elective politics while ensuring its public accountability, trust and transparency, as well as the durability and sustainability of management and operational changes.

IMG recommended that a "public trust" be created to accomplish this, but the BRP believes that these governance goals can be attained more quickly and effectively by preserving PWSA as an authority under the Municipal Authorities Act (MAA). The BRP recommends the creation of an independent Board of Nominators (BON) that will be initiated through mayoral appointments, but would be self-perpetuating after its initiation. The mayor will appoint the initial BON from a list of nominees submitted by the BRP. The BON would consist of five members (with staggered terms) who are well regarded for their competence, experience, and demonstrated community engagement, and who reflect the diversity of the city and be geographically representative of the city. The BON will be charged with electing PWSA's Board of Directors (BOD), and evaluating its performance, ultimately ensuring the success of the PWSA.

The BOD will be charged with oversight of PWSA including public health and safety, fiscal management, efficiency and productivity, and continuation of affordable rates. The BRP recommends that the BOD consist of nine, independent members, all of whom must live within the PWSA water service area. BOD members will also be known for their competence and experience and, as a group, reflect the City's diversity. In addition, the BRP recommends that the BON assure that the BOD include areas of expertise relevant to the operations and management of the PWSA. These may include, but not be limited to, the following areas: financial, legal, engineering, public utility management, and human resources/management.

To ensure that the BOD operates in the best interests of PWSA, the directors' performance will be evaluated by the BON on an annual basis, utilizing a set of defined performance metrics, as well as a Board of Directors survey. The BOD will elect its officers (Chair, Vice Chair, Secretary and Treasurer) on an annual basis. Further, the BON and BOD will hold an annual joint meeting to address BOD performance, as well as PWSA's goals and priorities for the upcoming year.

Short-Term Strategy: Creation of a contract between the City of Pittsburgh and Pittsburgh Water and Sewer Authority (PWSA) that creates a new governance framework for PWSA.

To effect these governance changes as quickly as possible, the BRP recommends the creation of a contract between the City and PWSA. This contract will set forth the guiding principles and framework of governance as outlined above. The BRP recommends that an independent legal counsel be engaged to draft this contract, which will be effective by March 31, 2018. The BRP also recommends that the Blue Ribbon Panel be continued and that it be included in the contract negotiations.

The contract will create the BON, identify its members, restrict the Mayor and City Council from future control of BOD appointments, and define the process by which the BOD is appointed and the structure within which it operates (terms, frequency of meetings, etc.). Among the provisions of the contract, the characteristics and qualifications of both BON and BOD members will be included.

Long-Term Strategy: Amend the Municipal Authorities Act and PWSA Enabling Legislation and Organization Documents.

A contract is not the best vehicle to provide confidence that the governance changes will be permanent. In parallel with the contract development, the independent legal counsel will draft amendments to the MAA and PWSA's enabling legislation and organization documents to permanently implement the governance changes. These amendments should then be aggressively pursed at the City and State level with the expectation of full approval in 2018.

II. Operations

PWSA has made significant improvements in every aspect of its operations during the last several months—improvements that one outside expert characterized as "extraordinary". The BRP agrees that there has been significant progress, based on its own review of the PWSA's plans and data on benchmarks provided by PWSA management. Yet, there is much more to be done, which is one of the major reasons for the proposed governance changes. In addition, the current, improved state of PWSA has been described as "fragile" by the same experts who give the current management high marks. Thus, it is important that the momentum of change and improvement be maintained and that remaining deficiencies in operations receive urgent attention.

PWSA must fix its system by pursuing an infrastructure repair and replacement program, which is discussed in the next section. At the same time, it must do the best it can with the system as it exists. This means bringing competence and ingenuity to the constant commitment of delivering safe drinking water every day. This also means rebuilding the public trust that it has lost, and that will require much better communication and transparency, as well as becoming an organization with a culture of customer service.

The current BOD, even while the new BOD is being created, should support PWSA management in making continued and rapid progress in: recruiting, retention and training of staff, including the removal of the city residency requirement and recalibration of salary levels to be market competitive;

continuation of the work that has established national benchmarks for operations, including significantly upgraded monitoring and data collection; and, implementation of the capital improvement plan.

Based on the Blue Ribbon Panel's review of the numerous reports and studies that assessed PWSA, including audits by the City Controller and the State Auditor General, as well as the BRP's discussions with various stakeholders, the Panel believes several specific actions should be taken to improve PWSA as soon as possible. In recommending these actions, the BRP recognizes that many of the things we think should change have a long history and that some of these changes will have a negative effect on some constituencies. Nevertheless, it is time that we all realize that these historical arrangements have had, and will continue to have, significant deleterious effects on PWSA unless we change them. The Blue Ribbon Panel therefore recommends the following actions be implemented as soon as possible:

1. Eliminate the Subsidy for Pennsylvania American Water Company. PWSA currently pays PA American Water a subsidy for Pittsburgh residents who are PA American Water customers based on the difference between PA American Water rates and PWSA rates. The BRP does not believe this subsidy makes economic or business sense especially given the condition of PWSA versus PA American Water. Further, this subsidy disguises what PA American Water actually charges its city resident customers for water. This change will result in immediate financial benefit to PWSA of several million dollars. In addition, it would make PA American Water more accountable to its customers for the rates it charges.

2. Cease the Subsidy of the City Under the Cooperation Agreement. PWSA is paying approximately $7.1 million dollars per year to the City for services from the City. However, the City does not provide services valued at close to this payment. This "subsidy" should be eliminated and PWSA should only pay the City for services that it desires at a mutually agreed to fair market value rate. Likewise, the City should pay the PWSA for any goods and services provided by PWSA to the City.

3. Cease the Free Water Subsidy. PWSA provides free water to the City and certain related parties (i.e. Pittsburgh Zoo and PPG Aquarium, Phipps Conservatory and Botanical Gardens, The National Aviary and Schenley Golf Course). These users should be treated no differently from any other PWSA customer. All users should be metered and charged. Achieving this would also provide better information on water lost from the system.

4. Eliminate the Domicile Policy. The City residency requirement for PWSA needs to be eliminated. The pool of qualified talent willing to work for PWSA is already narrowed because of PWSA's troubles.

5. Transfer ALCOSAN Billing and Collections to ALCOSAN. Currently PWSA is required to perform ALCOSAN's billing of ALCOSAN's city and certain non-city residents (this includes PA American Water customers). ALCOSAN charges (and receives) full payment from the PWSA; however, the PWSA bears the full risk of non-payment by ALCOSAN customers. This billing arrangement was established at a time when ALCOSAN was in the early stages of its operations. The justifications for this arrangement no longer exist. ALCOSAN certainly has the operational, financial and management capabilities to bill its own customers and bear the risk of its customers' nonpayment. Similar to the elimination of the PA American Water subsidy, this change would not only assist PWSA financially, but would also make ALCOSAN more accountable to its customers for the rates it charges.

6. Implement a Stormwater Fee. PWSA must make a significant investment (over $1B) to comply with the Federal consent decree associated with combined sewer overflow issues. Currently,

sewage and stormwater conveyance is billed based on water usage. A stormwater fee would assess a charge based on the amount of stormwater runoff a property creates and therefore align the cost to fix the issue to the source of the problem -- those properties that are generating significant stormwater overflow (i.e., large commercial properties, parking lots and other large impervious surfaces v. individual rate payers).

7. Cease Subsidies of Development Projects. PWSA is often asked to subsidize certain key development projects by providing water and sewer infrastructure that should be paid for by the developer. This should cease immediately. PWSA should be run as a utility, not an economic development agency.

Action steps 1-3 can be accomplished immediately by PWSA, the Mayor and City Council by an amendment to the Cooperation Agreement and repeal of related City ordinances. Action step 4 can be accomplished immediately by a resolution of PWSA's Board of Directors. Action step 5 can be implemented by a change to the Agreement between PWSA and ALCOSAN. Action Step 6 requires PWSA to amend its organizational documents to specifically provide for management of stormwater. PWSA has already developed a detailed stormwater plan. The Mayor in cooperation with PWSA should immediately establish a task force to finalize and implement the PWSA stormwater plan. PWSA's Board should then implement the stormwater fee. Action step 7 can be implemented by the PWSA Board's refusal to authorize any further subsidy for development projects.

III. Infrastructure

There is general agreement that the PWSA system has very large capital needs, and that these needs must be prioritized and addressed with a sense of urgency. Indeed, PWSA has developed a capital improvement plan which it is pursuing. IMG has recommended entering into an agreement with a private entity for the purposes of pursuing this or a revised plan. The BRP does not reject this idea, but it notes two important observations made by the Mayors Innovation Project: such an arrangement, while used in several non-water infrastructure systems, has been pursued rarely, if at all, for water systems; and, water systems, unlike other infrastructure, has an operational character that is closely tied to the infrastructure. Thus, the BRP believes that creating a separate entity or agreement for infrastructure would be risky.

PWSA should continue to pursue aggressively its risk-based capital improvement program. When the governance changes are implemented, the new BOD should consider IMG's proposal and other alternatives, taking into account all of the benefits, costs and risks.

In addition, The Mayor and the region's Harrisburg delegation should explore an immediate amendment to the state's Separations Act to permit PWSA to use more efficient and timely methods to implement its capital projects such as "design/build". The BRP expects that such a change would be supported by other municipalities in the State that are facing similar infrastructure challenges. The scope and urgency of PWSA's capital improvement program requires the use of innovative approaches and should not be handcuffed by a 100+ year old public bidding statute.

PWSA's implementation of its infrastructure plan is obviously connected to the Authority's financial situation and its ability to access capital. PWSA currently has about $600 million of senior lien debt and some challenges as it develops strategies for refinancing, as some of that debt has significant defeasance fees that would make it expensive. Despite those legacy issues, in the last several weeks PWSA successfully refinanced $380 million of that debt in two tranches. The first tranche, which was for $163 million with an average duration of 12 years, was rated A/A2 by the rating agencies at an all-in cost of 2.4%. This is a very good rating and it bodes well for the future. The second tranche included $218 million of variable-rate debt (based on the SIFMA index) that had interest rate swaps that synthetically fixed the rate at 4.04%. PWSA was able to refinance that debt at substantial cost savings. These developments are a reason for optimism about the future as the PWSA codifies and seeks to implement its broader capital plan.

It is important to keep in mind that the success of any infrastructure plan is intimately tied to people, processes and governance. Essential elements of a successful capital improvement program include: a well developed and competent organization that can interface effectively with all stake holders, good governance, effective and stable leadership, and organizational competence and expertise. These non-infrastructure elements are weighed heavily in the assessment of capital plans by Wall Street, bond holders, debt owners and rating agencies. PWSA must embrace all of these elements in order to implement an effective and robust capital program.

Broadly speaking, PWSA is on a good track for its capital plan and achieving its short-term goals. However, long-term success will require the continued transformation of the organization, and achieving that requires a fundamental change in governance.

OTHER ISSUES

Research: Innovation and continuous improvement are important for every organization, but especially one trying to make the most of a struggling system. PWSA should consider establishing a small research division or group(s) within existing divisions.

Regionalization: Political boundaries and subdivisions do not match the natural boundaries of watersheds and river basins. Regions that understand this and have created oversight and management bodies that overcome this mismatch are much better positioned to achieve efficient and effective water management. Southwest Pennsylvania is not such a region; in fact, we are likely the most fragmented region in the U.S. in terms of water management. This is a problem for Southwest Pennsylvania, and it costs us dearly.

PWSA must "get its house in order," but, once it does, opportunities for regional coordination and cooperation should be pursued. In addition, the potential for such regional cooperation should be a consideration in any change in PWSA's organization and enabling legislation.

Appendix A. Advisors to the Blue Ribbon Panel

Deborah Gross
Councilwoman and Member of the PWSA Board

Michael Lamb
City Controller

David Lassman, Distinguished Service Professor
Carnegie Mellon University

David Miller, Professor of Public and International Affairs
University of Pittsburgh

Alex Sciulli
Engineering Consultant

Sylvia Wilson, Member, Pittsburgh Board of Education
Chair of the ALCOSAN Board

Appendix B. Sources of Information

1. IMG reports and presentations
   - Presentation to the BRP on 8/28/17
   - Briefing Book on PWSA Restructuring Options, 8/28/17
   - An Overview of Citizens Energy Group (Indianapolis)
     Presented by Daniel Evans on 9/12/17
   - Executive Summary of PWSA Options, Asset Management, Capital Programming and Legal Assessments, presentation on 10/17/17 with supporting documents from IMG (capital investment, asset assessment and operations), Grant Thornton (financials, internal controls and IT) and West Group (existing agreements and applicable laws)
   - Briefing to the BRP on the PWSA Restructuring Options Assessment, 11/8/17
   - Task 5 Report: Restructuring Options and Recommendations, 11/27/17

2. PWSA
   - Presentation to the BRP on 11/21/17 by
     Robert Weimar, Interim Executive Director
     Kent Lindsay, CFO
     Mark Nowak, Solicitor
     Seth Garrison, Consultant
     Debbie Lestitian, Chair of PWSA Board, accompanied by other PWSA Board members
   - "Focusing on the Future: PWSA's Roadmap for Success", November, 2017
   - Executive Director's Report, November 2017, Performance Metrics, 12/15/17
   - Audited Financial Statements for 2015 and 2016

3. Audits
   - Performance Audit, City Controller, February, 2017
   - Performance Audit: Governance, Pennsylvania Auditor General, November, 2017
   - Comprehensive Performance Evaluation for the Aspinwall Water Filtration Plant, DEP and EPA, September 18-22, 2017

4. Mayors Innovation Project—Howard Neukrug, Patrick Cairo and Satya Rhodes-Conway "Review and Comments on PWSA Restructuring," December 8, 2017

   Some BRP members also had phone meetings with this group.

5. Carolyn Duronio (Reed Smith), facilitated by the Allegheny Conference on Community Development, telephone meetings and a memorandum, re "Governance Proposal for PWSA," dated December 8, 2017

6. Stakeholders Workshop organized by IMG and its partners on November 2, 2017

7. Our Water Campaign—meetings with individual BRP members

Executive Order City of Pittsburgh Office of the Mayor	
Subject: Implementing the Blue Ribbon Panel's Restructuring Recommendations	Number: 2018-01
By Direction of: William Peduto, Mayor	Date: January 22, 2018

WHEREAS, Mayor Peduto believes that reliable access to safe and affordable drinking water is a fundamental right; and,

WHEREAS, Mayor Peduto believes that public ownership of our water assets is the best vehicle to protect this right; and,

WHEREAS, the Mayor understands the challenges our current water system faces and comprehends that these system failures and deficiencies have created a crisis that must be addressed seriously and thoughtfully; and,

WHEREAS, because the Mayor understands that it is important to make long-overdue changes in the way The Pittsburgh Water and Sewer Authority (PWSA) is governed and invest in our water and sewer infrastructure, he appointed the Blue Ribbon Panel in March of 2017 to advise the City on the selection of a consultant to provide an independent review of the current state of PWSA and recommendations for improvement; and,

WHEREAS, the Blue Ribbon Panel hosted three public meetings and met privately a total of seven times to explore the nature of PWSA's challenges, to digest information from various sources (the consultant, PWSA, etc.), to evaluate the options and to reach its final recommendations; and,

WHEREAS, the Blue Ribbon Panel Report was issued on December 28, 2017, which was the culmination of the Blue Ribbon Panel's work over the past eight months; and,

WHEREAS, while the Blue Ribbon Panel report stated that PWSA has made significant progress in recent months, PWSA, working with its new Board of Directors, must continue to pursue aggressively its transformation into a high-functioning, customer-oriented organization and its plan to repair and replace the existing water supply infrastructure; and,

WHEREAS, the Blue Ribbon Panel stated clearly PWSA remain a public entity, and the City should retain ownership of the system; and,

WHEREAS, in addition, the Blue Ribbon Panel Report stated that PWSA should remain a municipal authority, but it must be thoroughly reorganized to make it independent of elective politics and accountable to and trusted by the public; and,

WHEREAS, the Auditors General's report on the performance of PWSA issued on November 1, 2017, recommended that PWSA amend its articles of incorporation to require that PWSA Board seats be filled by individuals not compensated by the city; and,

WHEREAS, the Blue Ribbon Panel Report organizes its recommendations into three pillars: (1) governance, (2) operations, and (3) infrastructure;

NOW, THEREFORE, I, William Peduto, Mayor of the City of Pittsburgh, by the virtue of the authority vested in me by the City Charter and laws of the City of Pittsburgh do hereby direct the following:

1. The Blue Ribbon Panel is directed to engage and supervise an independent restructuring legal counsel to prepare a contract between the City and PWSA that will implement the governance changes recommended by the Blue Ribbon Panel Report.

2. The creation of an independent Board of Nominators (BON) that will be initiated through mayoral appointments, but would be self-perpetuating after its initiation. The details of this creation are as follows:

    - The Mayor will appoint the initial BON from a list of nominees submitted by the Blue Ribbon Panel. The BON would consist of five members (with staggered terms) who are well regarded for their competence, experience, and demonstrated community engagement, and who reflect the diversity of the city.
    - The BON will be charged with electing PWSA's Board of Directors (BOD), and evaluating its performance, ultimately ensuring the success of the PWSA.
    - The BOD will be charged with oversight of PWSA including public health and safety, fiscal management, efficiency and productivity, and continuation of affordable rates.
    - The BOD will consist of nine, independent members, known for their competence and experience and, as a group, reflect the city's diversity.
    - The BOD will include individuals with expertise relevant to the operations and management of the PWSA. These may include, but not be limited to, the following areas: financial, legal, engineering, public utility management, and human resources/management.

3. The final contract between the City and PWSA should be executed and implemented by March 31, 2018.

4. The Blue Ribbon Panel will also engage and supervise the independent restructuring legal counsel to prepare proposed amendments to the Municipal Authorities Act, PWSA's organizational documents and enabling legislation, and other state and local laws and ordinances, as necessary, to make the foregoing governance changes permanent.

This Executive Order shall take effect immediately and remain in effect until amended or rescinded in writing by the Mayor.

Hyperlinks (if necessary):

https://pwsablueribbon.org/wp-content/uploads/2018/01/BlueRibbon_Recommendations.pdf

http://www.paauditor.gov/press-releases/auditor-general-depasquale-says-audit-of-pittsburgh-water-and-sewer-authority-shows-urgent-need-for-immediate-action

Exh. RAW/C-6

PITTSBURGH'S WATER FUTURE

2030

AND BEYOND

PGH2O 2030

OCTOBER 2018

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DEAR PITTSBURGH:

Thank you for the opportunity to serve you. We at PWSA are grateful to Mayor William Peduto for asking us to report our 12-year plan for Pittsburgh's water systems (drinking water, stormwater, and sewer). This plan, which we are calling PGH2O 2030, spells out where we are as a water utility and how we see ourselves improving over the next year and beyond. Make no mistake: Pittsburgh's water systems are YOUR water systems. Generations of Pittsburghers before us built them for you. You own them. We work to make our systems meet your expectations.

PGH2O 2030 lays out our vision for rebuilding and upgrading the drinking water, stormwater, and sewer systems that will make future generations of Pittsburghers proud. It articulates our goals for PWSA, including transparency, accountability, reliability, affordability, and more.

We are not naïve – as a water utility, we have fallen short in the past. Our water systems were neglected for decades, starved of needed investment to keep them better maintained and modernized. Our customer service was not responding to customer needs and was not able to keep up with accurate billing. The PGH2O 2030 plan includes our Roadmap to Renewal; a new chapter in our story, with new leadership, a new commitment to our customers, and new plans to move us into the future.

PWSA Customer Service has improved response times, we are upgrading our phone system to improve our customer experience, are installing modern water meters capable of two-way communication, and are providing continuous training to improve the level of service customers are receiving. Within the past year we introduced a number of assistance programs like our bill discount program, winter shutoff moratorium, and cash assistance to help our most vulnerable customers pay their bills. We are working to expand our assistance to customers that need financial help.

We are primed to invest significantly in our water systems, so we can provide safe, reliable water and sewer service, resilience against flooding and natural disasters, improved water quality, and a healthier environment. PGH2O 2030 lays out our strong financial footing that will allow us to invest at the levels necessary for a major infrastructure overhaul. We offer a preview of some coming projects, and include some interesting photographs, both from our historical archives and behind the scenes photos of the work we do every day.

We want Pittsburgh to take pride in our water. You own these systems, and they have served us well for more than a century. With renewed vision and leadership, we will restore PWSA to serve the public for the next century too. We are your neighbors as well as public servants who work for you, so please let us know how we are doing when we see you around town. ***We want to get this right. This is our water, and our future.***

Sincerely,



Robert A. Weimar
Executive Director



Paul Leger
Board Chairman

OUR VISION:

PWSA WILL PROVIDE PITTSBURGH WITH THE SAFE, RELIABLE WATER SERVICES IT NEEDS *NOW AND FOR GENERATIONS TO COME.*

Pittsburgh's history is linked to our water. We are fortunate to live in one of the most water-rich regions in the country, and our rivers made this city what it is today and connected us to the world.

Our rivers, and the bridges that span them, make our skyline iconic.

Every day we rely on the infrastructure that brings water to us and takes it away when we're done. Water is essential to everything we do.

We need water to make a pot of coffee, brush our teeth, or make food. Penguins need water to go swimming at the Aviary, and our Pittsburgh Penguins need (frozen) water to play hockey on too.

Boaters want clean water in our rivers. Phipps needs it to water flowers, firefighters need it to put out fires, breweries need it to make beer.

Doctors and nurses need water to keep their hands clean, and everyone with a toilet wants water to be there when it is needed.



Our water systems are engineering marvels, built nearly a century ago.

They use smart, energy efficient design that takes advantage of our natural topography to make sure gravity – along with the help of pump stations, reservoirs, and tanks – moves water through our hills and valleys.

This has served us well for generations, and with the necessary repairs and upgrades, it can serve us for generations to come.

We are excited to present our vision, goals, and plan to bring safe, reliable drinking water, stormwater, and sewer service to Pittsburgh and the region through 2030 and beyond, using new smart technology to meet the needs and expectations of the future.

At PWSA, we take water stewardship seriously. Countless improvements are already underway to our drinking water treatment and distribution systems. We are rebuilding our aging sewer lines, and designing innovative stormwater mitigation projects to reduce pollution and flooding.

Our vision is for everyone in every neighborhood in Pittsburgh to have access to safe, reliable drinking water and sewer service, 24 hours a day, 7 days a week.

By 2030, we will have removed all lead service lines, ensuring a safe, healthy future for Pittsburgh children and families.

We will complete investments in projects to improve water quality, to ensure we are meeting, and exceeding, regulatory, compliance, and public health standards.

We live in these neighborhoods too, and nothing is more important to us than the health and safety of our neighbors.

We envision an equitable water future, in which water rates are affordable while remaining in-line with the cost of repairing and maintaining our system, everyone's bill accurately reflects the amount of water they use, and bill assistance is available for customers who need it.

Water equity also means workforce development and hiring practices that ensure the money spent by PWSA is reinvested in our community.

PWSA is also investing millions of dollars into rebuilding our sewers. Out of sight and out of mind, most people don't think much about sewers that take wastewater away. But sewers are critical to our water infrastructure system.

Built a century ago for a city that had a different physical footprint and a different population, our sewers are due for maintenance and upgrades.

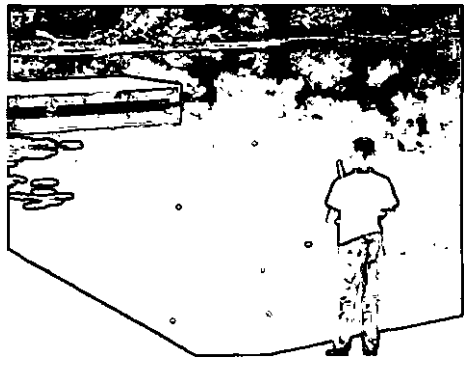
Our vision is for a modern sewer system that keeps sanitary sewage flowing where it belongs, flowing to wastewater treatment plants, not backup up into basements or overflowing into rivers.

And our environmental future relies on the success of our water infrastructure. To reduce pollution in our rivers, we will repair our sewers and invest in innovative stormwater infrastructure projects that will treat and mitigate stormwater runoff.

Our waterfront development and health of our waterways depends on our success. Our downstream neighbors rely on us to return safe clean water to our rivers before it flows down to them.

With an emphasis on green-first, environmentally friendly design principles and construction practices, we will upgrade already great water systems and renew them to take us through the next 12 years and be ready for the next 100 years.

And we'll do it with transparency and accountability to the public. We are public servants, we know we are all in this together.



Generations before us built incredible public water systems, and we owe it to generations to come to leave those systems better than we found them.

This is our water, our Pittsburgh, and our future.

OUR GOALS:

TO RESPONSIBLY, SUSTAINABLY MANAGE PITTSBURGH'S WATER FOR THE NEXT 12 YEARS, AND WELL BEYOND 2030

TO PROVIDE SAFE, RELIABLE WATER 24/7/365 TO OUR CUSTOMERS AND TO PROVIDE THEM WITH EXCELLENT CUSTOMER SERVICE

TO RENEW AND UPGRADE OUR DRINKING WATER, STORMWATER, AND SEWER INFRASTRUCTURE TO EXCEED ALL COMPLIANCE STANDARDS







TO PRIORITIZE PUBLIC HEALTH AND REPLACE ALL LEAD SERVICE LINES

TO MAKE WATER SERVICE ACCESSIBLE THROUGH CUSTOMER ASSISTANCE TO OUR LOWER-INCOME CUSTOMERS AND CONTINUE A MORATORIUM ON WINTER WATER SHUT-OFFS

TO BE ACCOUNTABLE, ACCESSIBLE, AND FULLY TRANSPARENT TO OUR CUSTOMERS

TO FAIRLY AND EQUITABLY CHARGE EACH CUSTOMER BASED ON THEIR USAGE OF OUR SYSTEM

TO BE A VALUED REGIONAL ENVIRONMENTAL STEWARD OF OUR MOST PRECIOUS RESOURCE

ROADMAP

We know PWSA has not always been perfect. After ingenious drinking water and sewer infrastructure was built for our city generations ago, those systems were neglected and fell into disrepair. Leaders failed to invest in our drinking water, stormwater, and sewer infrastructure, adopting a "fix it when it fails" mentality, and intervening only at a point of failure, which is the most expensive way to maintain a system.

PWSA experienced leadership turnover, making it difficult to finalize plans and see them through to completion. Some well-intentioned changes were poorly executed. As a result, we found ourselves out of compliance with regulatory standards. Lead levels in drinking water increased. Inaccuracies in billing went uncorrected, and PWSA failed to provide the customer service every resident deserves.

Thankfully, PWSA has turned the page. We are on the road to recovery. We have consistent, committed, proven leadership at the helm, and we have plans for 2030 and beyond. We're raising the revenue we need to properly maintain our systems and get ahead of the curve with repairs – including removing all lead service lines well before 2030. Our customer service and billing has improved, and we're implementing state-of-the-art systems to make sure PWSA not only complies with, but exceeds, regulatory standards.

STRONG FINANCIAL FOOTING

As a municipal authority, PWSA is able to obtain a very low interest rate on debt. As a public water system, we have access to municipal bond markets that investor-owned systems cannot access. And we have a strong track record of successfully competing for state and federal financing programs.

Much like the City of Pittsburgh and Allegheny County, lenders assess us favorably. Because of that strong finance position, we can continue to borrow at the lowest interest rates, securing investment in our Capital Improvement Plan.

ON THE PATH WITH THE PUC

Through a change in state law, the Pennsylvania Public Utility Commission (PUC) began overseeing PWSA on April 1, 2018. The PUC now oversees customer service, operations, performance, and ratemaking.

This transition offers PWSA customers new protections and opportunities. We believe PUC oversight only strengthens Pittsburgh's water future.

PUC supervision helps protect consumers, demands transparency and accountability, and keeps PWSA meeting the same expectations as other large utilities in the state. With PUC oversight, our customers can have peace of mind that we are monitored to use your rate money wisely.

At PWSA, we invest revenues generated from rates in critical infrastructure upgrades, no exorbitant management salaries, multi-million-dollar marketing campaigns, or making a profit for shareholders or investors. As a publicly-owned utility, Pittsburghers can rest assured that we take every dollar and invest it back into their drinking water, stormwater, and sewer systems.

THE ROAD AHEAD

PWSA is now looking toward the future. Our key investment areas include lead line replacement, infrastructure repairs and replacement, and coordination with other utilities and City departments and neighboring municipalities for cost savings and smart planning.

We are ahead of our schedule for lead line replacements and on track to have all lead service lines removed within the city within seven years.

We are also beginning to use Orthophosphate, a common, food-grade additive, that will help protect residents from lead in pipes.

No one wants their road paved three times in a year, so we are committed to working closely with the City and other utilities to "dig once" for repairs and paving.

We are always looking for ways to be more efficient, including increased coordination with City agencies to ensure water is considered when planning for new transportation and development projects.

We're also exploring ways to prepare for the future, such as installing conduits for fiber optic and other cables alongside our water infrastructure when we open a street to make repairs.

Space in these conduits could be rented to third parties in the telecom industry and elsewhere, generating revenue for the public and enhancing connectivity.

We are committed to rebuilding our systems in a way that is not only functional, but environmentally sustainable.

This starts with restoring our existing gravity-based systems, rather than building energy intensive pump-based systems.

We're also pursuing renewable sources for the energy that our system does use, including renewable energy technologies like solar panels on our facilities and infrastructure.

Our green-first approach to stormwater treats runoff using natural, passive methods that improve water quality.

And we're installing networked meters that will allow customers to monitor water usage in real time, providing information they need for water conservation.
The new leadership at PWSA is committed to restoring the glory of Pittsburgh's water system. We will build and maintain a water infrastructure system that we can all count on, now and in the future.

PWSA will be accountable and transparent, making sure all Pittsburghers get a voice in their water future through 2030 and beyond.

We are environmental stewards, ensuring we put clean water back into our rivers for ourselves and our neighbors downstream.
We are financial stewards, making sure we spend wisely.

We are your neighbors, we are accessible, we are your public servants -- here to deliver for you.

PAST PERFORMANCE ISSUES

- DECADES OF MINIMAL INVESTMENT IN INFRASTRUCTURE
- LACK OF BUDGET FOR MAINTENANCE AND UPGRADES
- "FIX IT WHEN IT FAILS" MENTALITY
- FREQUENT LEADERSHIP CHANGES
- INCONSISTENT REGULATORY COMPLIANCE

CURRENT PERFORMANCE ACHIEVEMENTS

- 5-YEAR, $1 BILLION CAPITAL PLAN
- STAFFING AND EQUIPMENT AT NEEDED LEVELS
- GETTING AHEAD OF THE CURVE ON REPLACEMENT
- NEW, COMMITTED EXECUTIVE LEADERSHIP TEAM
- NEW COMPLIANCE TEAM, USING STATE OF THE ART REPORTING

FINANCIAL STABILITY

PWSA IS COMMITTED TO AGING INFRASTRUCTURE *WATER QUALITY, ITS SAFE RELIABILITY OF THE WATE*

In 2018, PWSA began to build a Capital Improvement Plan ("CIP") that includes over $1 billion of capital improvements to be completed over the next five years. These improvements include upgrading the water treatment plant, drinking water, stormwater, and sewer systems, and building green infrastructure.

This comprehensive approach to rebuilding our infrastructure means we will be able to provide the water and wastewater service to meet or exceed customer expectations for current and future generations.

FINANCING

Unlike investor-owned utilities, PWSA does not have shareholders to generate a profit for. Instead, PWSA's primary focus is on delivering the best possible service, at the lowest possible cost, for our customers.

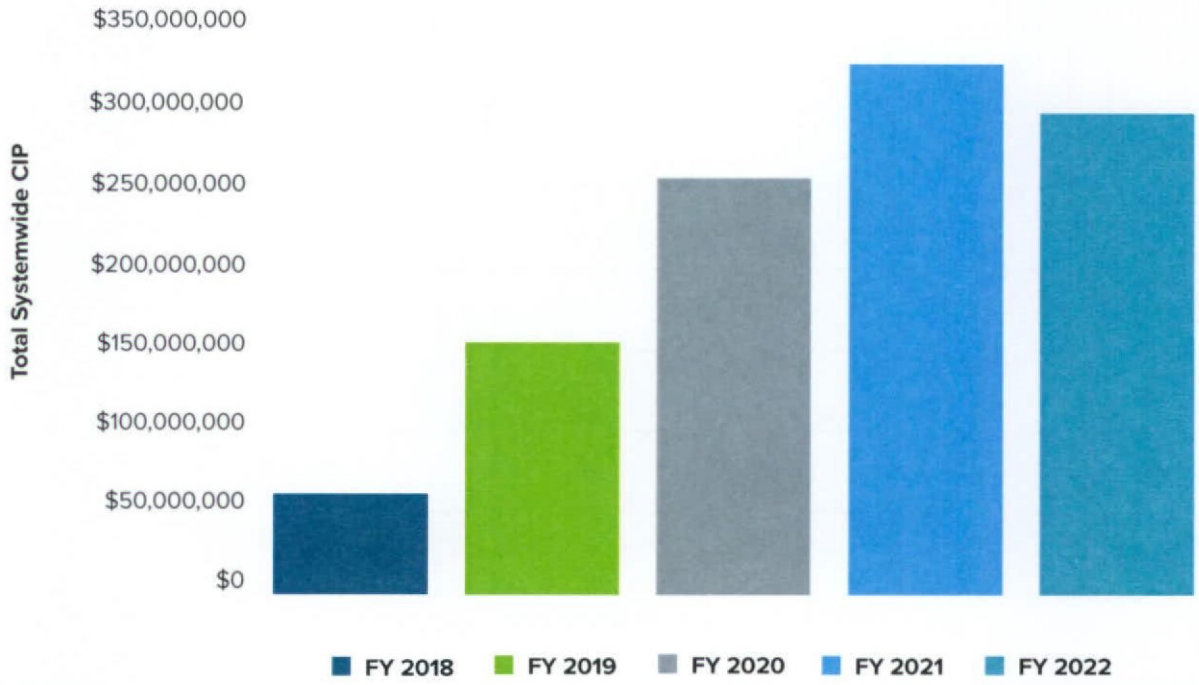
Therefore, PWSA's goal to fund the planned CIP is to use a mix of public financing sources to minimize the cost to our customers.

PWSA primarily funds our projects through revenue bonds. Revenue bonds are sold in the open financial marketplace and are secured by PWSA future revenue. Revenue bonds are considered a traditional funding method among public water and sewer utilities, allowing the cost of improvements to be spread across a larger portion of their useful life.

We will also explore state and federal programs, including grants and low-interest loans, to help fund the CIP. PWSA has a proven track record of successfully competing for these state and federal funding programs, and is in a strong position to continue to do so moving forward.

The last funding method that PWSA will utilize is called Pay-As-You-Go, which uses current

FIVE YEAR CAPITAL IMPROVEMENT PLAN (CIP), FISCAL YEAR 2018-2022



IVESTING IN ITS O IMPROVE Y, AND THE SYSTEM.

year revenues to pay for current capital investments. This approach lowers the financing costs by eliminating the need to borrow money to fund capital projects.

These financing programs are only available to public water and sewer utilities, and their favorable financing terms allow public utilities to deliver capital improvements for ratepayers at a lower cost of capital than could be achieved through private financing.

Historically, PWSA has been able to obtain low municipal interest rates on debt. The ability to issue municipal bonds is only available to public agencies, and the lower interest rates allow us to deliver capital improvements for ratepayers at a lower cost of capital than could be achieved through private financing.

Thanks to our public ownership and strong financial position, for fiscal year 2019 we are estimating an annual interest rate of 3.93% on all our current combined outstanding debt.

PWSA's credit ratings as assigned by Moody's Investor Service and S&P Global Ratings are considered upper-medium grade and low risk credit. This *reflects our low risk of default* and strong capacity to meet our financial obligations.

In addition, S&P Global Ratings classifies PWSA as having a very strong enterprise risk portfolio and a strong financial profile. This can be attributed to the stable water and sewer revenue sources of PWSA from the areas it serves throughout Pittsburgh.

Strong credit ratings will give PWSA the ability to obtain favorable financing to fund needed system improvements.

LONG-TERM FINANCIAL PLANNING

PWSA adopted long-term financial planning initiatives that include implementing financial policies, monitoring financial metrics, and modernizing the capital and operating budget processes.

Together, these initiatives will stabilize and improve the financial position of PWSA for years to come.

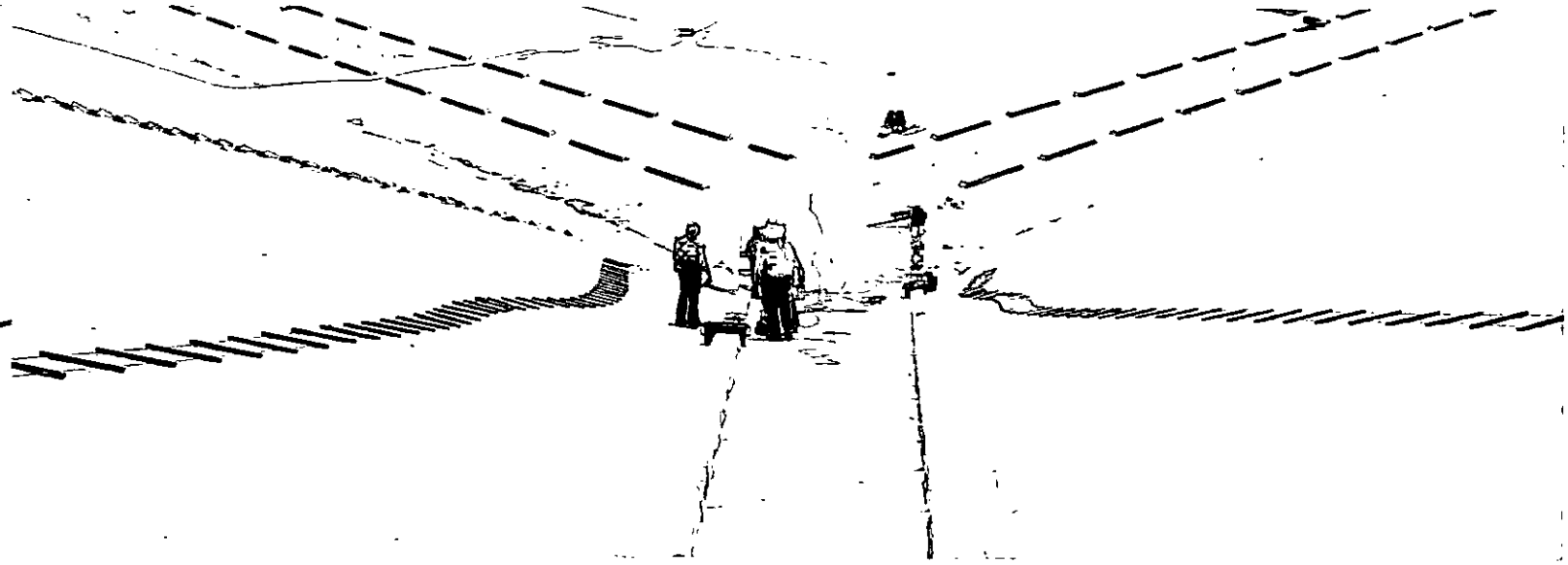
PWSA has and will continue to adopt and follow best practices for financial policies and governing principles. This includes providing guidance on the capitalization of assets, issuance of debt, cash management, and financial management.

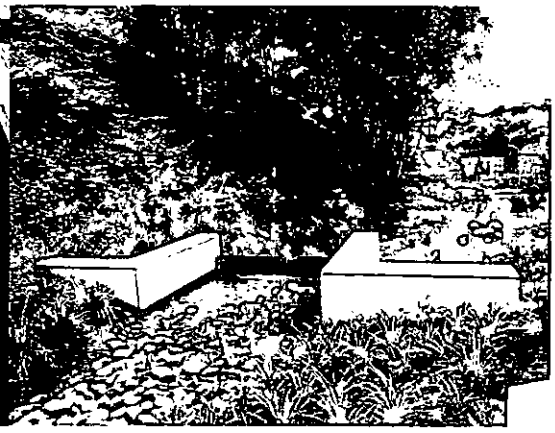
All adopted policies will ensure that the public's interests stay a top priority when we make any financial decision.

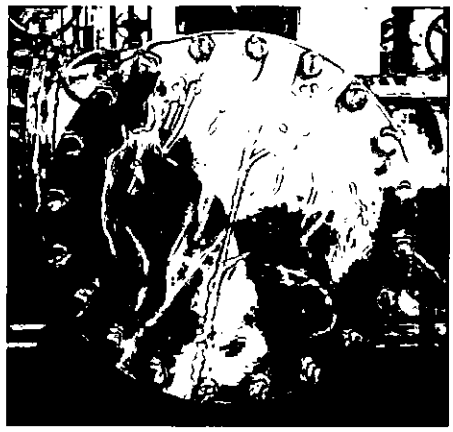
In addition, PWSA will also use *the following financial metrics* to evaluate and track financial success:

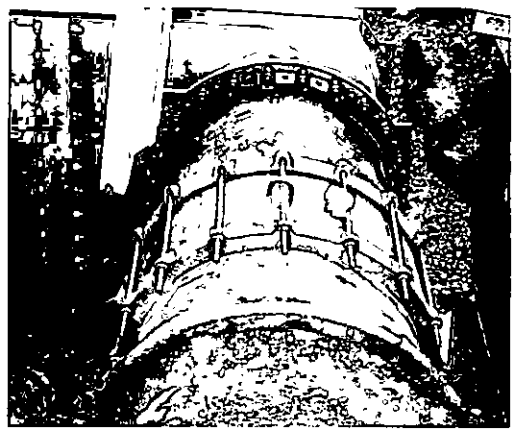
- **Maintaining** a debt service coverage ratio of 1.35x on senior debt service obligations.
- **Maintaining** a debt service coverage ratio of 1.15x on total debt service obligations.
- **Increasing** the percentage of Pay-As-You-Go funding to at least five percent over the next five years.
- **Achieving** cash reserves, including operating reserves, rate stabilization fund and revenue fund at a level of 65 days cash on hand as measured at the end of fiscal year 2019, with the ultimate goal of increasing to over 100 days over the next five years.

INFRASTRU



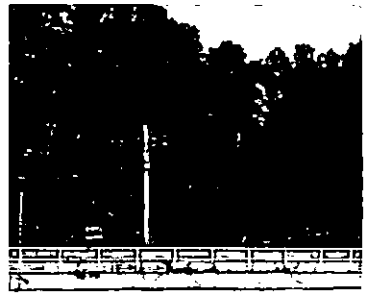


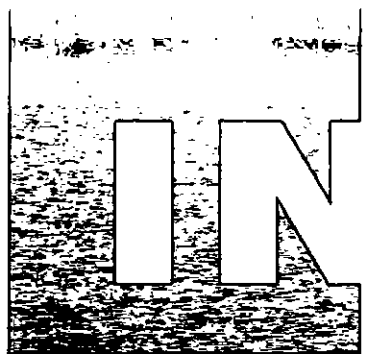








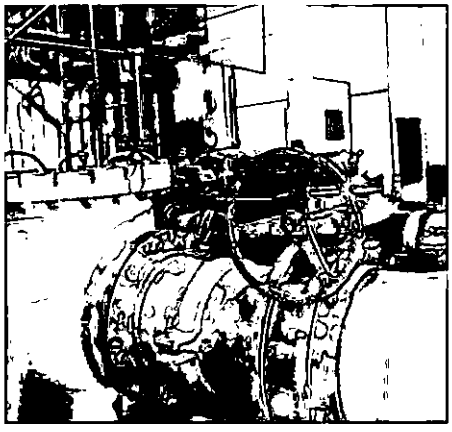




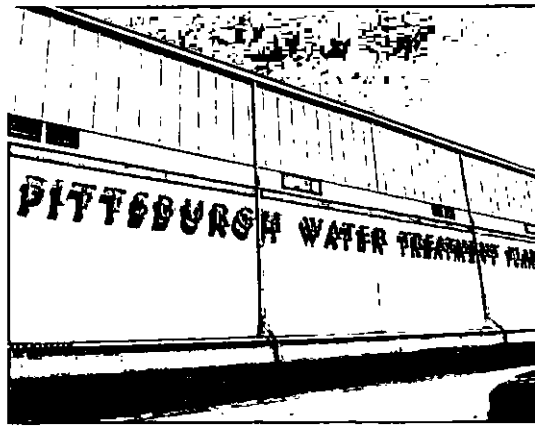
JCTURE

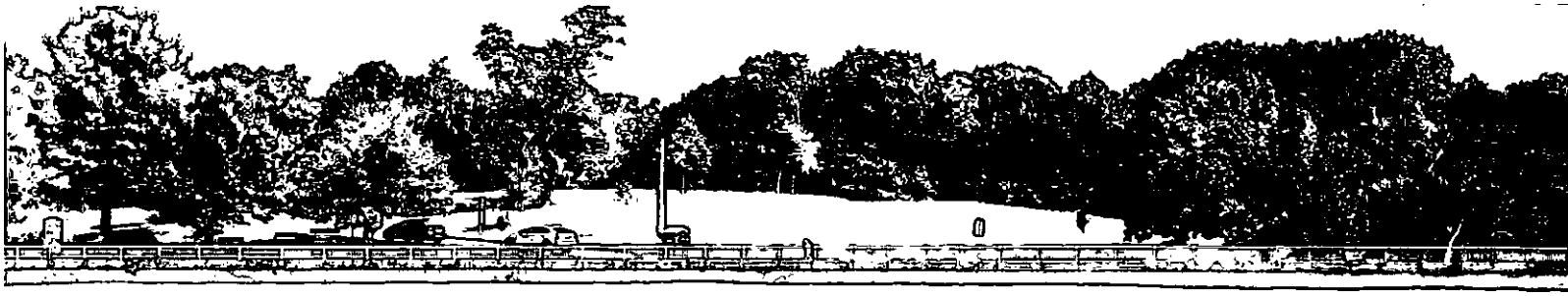












VESTMENT

DRINKING WATER

Our top priority is delivering safe, reliable drinking water to all of our customers. We are committed to making the upgrades to the drinking water system necessary to achieve that goal.

Some of our improvements are obvious, like removing all lead lines in our system before 2030.

But some are less obvious, such as building in intentional redundancy and resilience, so if a problem arises in one area, we can work around it and continue to deliver safe water to residents everywhere.

We also are committed to providing Pittsburgh with a water system that delivers reliable fire protection, which means we have to be able to deliver water at the pressure firefighters need to put out fires.



We will also meet water pressure regulatory requirements, and ensure accurate billing for all customers.

Read more about some of our drinking water projects that are scheduled for the coming years:

ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN

The existing 60-inch rising main that supplies the Lanpher Reservoir is a riveted steel pipe that is more than a century old. It carries water from the Aspinwall Pump Station to the Lanpher Reservoir and provides connections to critical customers such as St. Margaret Hospital and bulk customers – the townships and municipalities we serve that are outside of the city. In recent years, due to the age of this pipeline, this critical component of our water distribution system has experienced breaks and failures.

Providing a new redundant rising main is necessary to ensure the reliability of the northern portion of our water distribution system. It will add resiliency and serve as a primary supply source for the Lanpher Reservoir when we begin the Clearwell Improvement project.

This capital improvement project is estimated to cost $49 million.

LANPHER RESERVOIR IMPROVEMENTS

PWSA's reservoirs and tanks are the backbone of our drinking water distribution system. Located at high elevations, they use gravity to supply the pressure needed to move water throughout our service area.

By working with nature instead of against it, our gravity-based system keeps the system simple and energy efficient, reduces the need for pumps, and ensures that we can maintain water pressure even when parts of the city are without power.

Our reservoirs also ensure that we have redundancy and resiliency in our system. They allow us to store large quantities of treated water, so if part of the system is temporarily out of service for maintenance, water from the reservoirs can be re-routed to maintain full service.

In summer of 2018, PWSA restored 90 million gallons of drinking water storage capacity by completing the major renovations to the western cell of the Lanpher Reservoir located in Shaler Township.

This project involved replacing the cover and liner of this critical treated drinking water storage facility which provides water to PWSA's customers in Pittsburgh's northern neighborhoods, the Borough of Millvale, and Reserve Township.

With the western cell fully restored, PWSA has begun work on the eastern cell. The entire Lanpher Reservoir renewal project includes improvements to the perimeter wall, the gatehouse as well as construction of new metering and new facilities to improve water quality.

This project is estimated to cost $30 million.

WATER MAIN REPLACEMENT PROGRAMS

PWSA has approximately 960 miles of water mains with an average age of about 80 years old. More than 40 percent were installed prior to 1920.

Given the age of the system, and lack of spending in prior years, PWSA is initiating a water main renewal program. Pipeline condition assessments and overall system prioritization is being formalized. Over the next several years, PWSA will replace small diameter water pipes at an annual replacement rate of 20 miles of pipe per year.

After that aggressive program, our long term water line replacement program will average about 10 miles per year. This proactive approach to managing the network of pipes that make up our water distribution system will improve system reliability and water quality, reduce breaks, and ensure that our firefighters have sufficient water pressure. It will also reduce water loss and service disruptions.

Coordinating water main replacements with other PWSA projects, as well as other utility and City projects, will reduce the overall cost of the renewal program.

LARGE DIAMETER WATER MAINS

PWSA manages 122 miles of large diameter water mains – 16 inches in diameter or larger. Many of these large diameter mains are made of riveted steel. These pipes are difficult to repair and often result in significant service outages and damage.

As such, PWSA is initiating a pipe condition assessment methodology to strategically plan for the renewal or replacement of these critical assets. Those pipes with the greatest risk of failure will be prioritized.

SMALL DIAMETER WATER MAINS

Strategically improving small diameter water mains will improve water pressure, maintain water quality, and minimize disturbances throughout Pittsburgh's neighborhoods. We are focusing on replacing mains that are undersized (4" and 6" in diameter), made of unlined cast iron and mains with a history of frequent breaks and/or water quality issues.

This is an ongoing capital program. Expenditures will range from $10 to $40 million per year.



WATER TREATMENT PLANT

Located along the Allegheny River, the Water Treatment Plant (WTP) draws our water and treats it before it's distributed to our customers in Pittsburgh and neighboring communities. Still considered a state of the art treatment process, the WTP, like much of the system, has suffered from a lack of investment in recent years. The last major modernization of the WTP was completed in 1969.

Today, we're prepared to once again reinvest in this critical facility. PWSA has identified a series of projects that will renew the treatment plant in its entirety by rebuilding its intake facilities, treatment systems and replacement of the century-old 44 million gallon Clearwell.

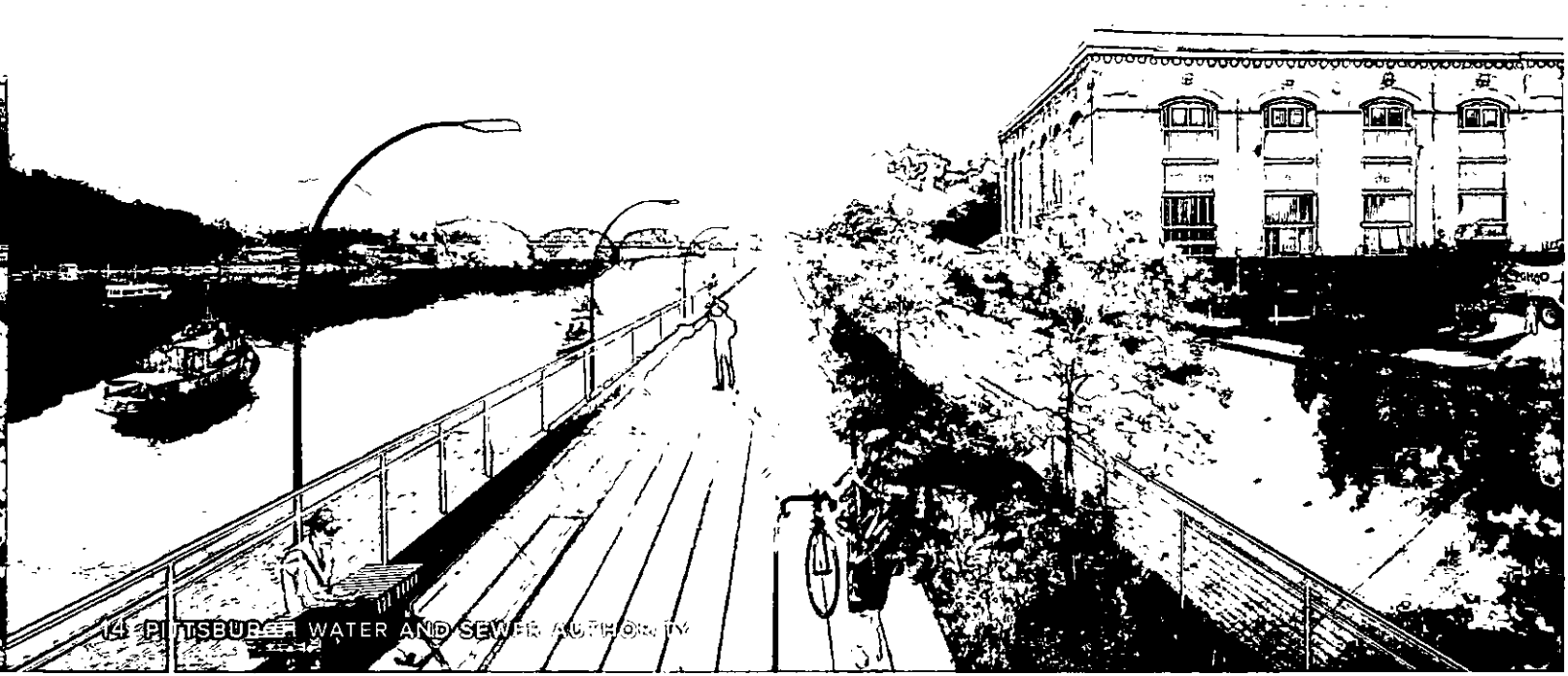
In addition, PWSA will upgrade its two finished water pumping stations, both more than 50 years old.

While the innerworkings of the plant are essential to the treatment and distribution of water, the exterior of the building, its connection to the river, and surrounding environment are also critically important to us. PWSA envisions modernizing the buildings to meet current standards for energy efficiency, utilizing renewable energy, and adhering to industry leading green building standards.

We are collaborating with Friends of the Riverfront to extend public trail access through our site to continue the trail system that follows the Allegheny River. The new water treatment facility will also incorporate a new community mural to highlight the historical significance of the rivers and their importance to Pittsburgh. These projects are in their planning and design phase and will be completed in sequential order to ensure safe and continuous distribution of water.

PWSA currently estimates the initial investment to be approximately $120 million.

Draft rendering of PWSA's Aspinwall Drinking Water Treatment Plant and Allegheny River Trail





HIGHLAND PARK PUMP STATION AND RISING MAIN

Projects, including replacing the existing Highland-Garfield Pump Station, adding a new rising main to connect the Highland Reservoir service area, and adding new pumping capacity, will ensure an uninterrupted and reliable water supply to over one-third of our customers.

The new Highland-Garfield Pump Station will replace the existing pumping station that was used to supply water to the Garfield Tank. It will also provide a supplemental and redundant supply of drinking water to the Highland I reservoir water district.

To connect the new pumping station to the Highland I Reservoir water supply system, a new 48- inch rising main will be constructed. The rising main will be near the upper entrance to Highland Park.

This project is in collaboration with the Pittsburgh Parks Conservancy, the Port Authority of Allegheny County, and the City of Pittsburgh's Department of Public Works and its Department of Mobility and Infrastructure to incorporate park features, mobility improvements, and green stormwater infrastructure to benefit the community. It is estimated to be completed in 2023 and cost $32 million.

HIGHLAND PARK MEMBRANE FILTRATION PLANT AND ULTRAVIOLET (UV) DISINFECTION SYSTEM

PWSA is installing an ultraviolet (UV) disinfection system at the Highland Park Membrane Filtration Plant (MFP) to provide enhanced drinking water treatment that will exceed state requirements and reduce potentially harmful disinfection byproducts. Treating water with UV disinfection is highly effective because UV attacks organisms at the genetic level, rendering them harmless. UV disinfection will also allow the Highland Park Reservoir 1 to remain uncovered and serve as an amenity to the public. When the project is completed, the MFP will provide up to 21 million gallons of treated drinking water per day.

In addition to the UV system upgrade, PWSA is completing security upgrades at the MFP and the Highland Park Reservoir 1. Upgrades include improvements to the reservoir wall and 24/7 video and live surveillance.

These projects will be completed in 2019 and will cost approximately $4.3 million.

STORMWATER

When the combined sewer and stormwater system is overwhelmed, pollution flows into our rivers and raw sewage can back up into basements. In other words, a failing stormwater system is a public health and safety issue.

In 2017, pollution flowed into our rivers more than 60 times because the combined system couldn't handle the volume of water.

PWSA's stormwater projects will capture and collect rain water – and treat it on site – so it doesn't immediately flow into the sewer system, mix with sewage, and overflow into a river or a backup into a basement.



Managing stormwater is challenging and costly, but because PWSA is publicly owned we can focus on doing what is right, for the long term, not what might be most expedient or profitable now.

That means pursuing green solutions to stormwater problems that are financially and environmentally sustainable.

We're focusing on critical areas so that we can turn today's biggest flooding and sewer backup risks into tomorrow's cleanest and greenest neighborhoods.

SAW MILL RUN

PWSA, in collaboration with 11 neighboring communities, is developing an integrated watershed management plan throughout Saw Mill Run.

The Saw Mill Run Watershed is one of the first plans within the Pittsburgh region to develop a collaborative approach to managing stormwater. The plan will help to spur economic development and improve the quality of life for those living and working in its surrounding neighborhoods.

Saw Mill Run currently uses traditional, end-of-pipe solutions to manage stormwater, which has led to flooding, high sediment loads, and combined sewer overflows. The Saw Mill Run plan will utilize a combination of techniques.

The estimated cost of this project, currently in its planning phase, is approximately $6.5 million.

FOUR MILE RUN STORMWATER IMPROVEMENT PROJECT

Four Mile Run encompasses Schenley Park and several neighborhoods including Greenfield, Hazelwood, Oakland, and Squirrel Hill. These neighborhoods, like many throughout Pittsburgh, experience the impacts of stormwater that has nowhere to go.

This project will capture and route stormwater through a natural channel that will follow the path of the historic streams that formed Four Mile Run from Panther Hollow Lake to the Monongahela River. Panther Hollow Lake overflows will be redirected to discharge directly into the Monongahela River instead of the combined sewer.

Redirecting the flow of water through a natural channel will help to prevent combined sewer overflows and reduce the intensity of flooding that occurs throughout Four Mile Run.

This project is in its design phase and will cost approximately $40 million.

NEGLEY RUN

PWSA is partnering with the Army Corp of Engineers, Pennsylvania Department of Transportation, and other stakeholders to design and construct a stormwater separation project along Washington Boulevard to provide a new stormwater outfall to the Allegheny River.

The project will also include wetlands development, detention and other features to reduce combined sewer overflow volume, reduce flooding, and improve water quality.

This project is in its design phase and is estimated to cost $15 million.

MAIRDALE AVENUE STORMWATER IMPROVEMENT PROJECT

The Mairdale Avenue Stormwater Improvement Project will improve the flow of stormwater through Riverview Park by using a combination of surface and subsurface green stormwater infrastructure solutions to stabilize stream banks, mitigate erosion, redirect and store stream flow, and capture stormwater runoff.

It will also decrease the occurrence of surface and basement flooding near the project area and reduce the amount of sediment and debris that often blocks the combined sewer system. The project will also enhance public amenities within the park.

Design costs for this project are approximately $1.8 million.

SOUTHSIDE PARK / 21ST STREET

The Southside Park/21st Street Stormwater Project is being designed to manage stormwater and stream inflows that enter the combined sewer system in the South 21st Street corridor.

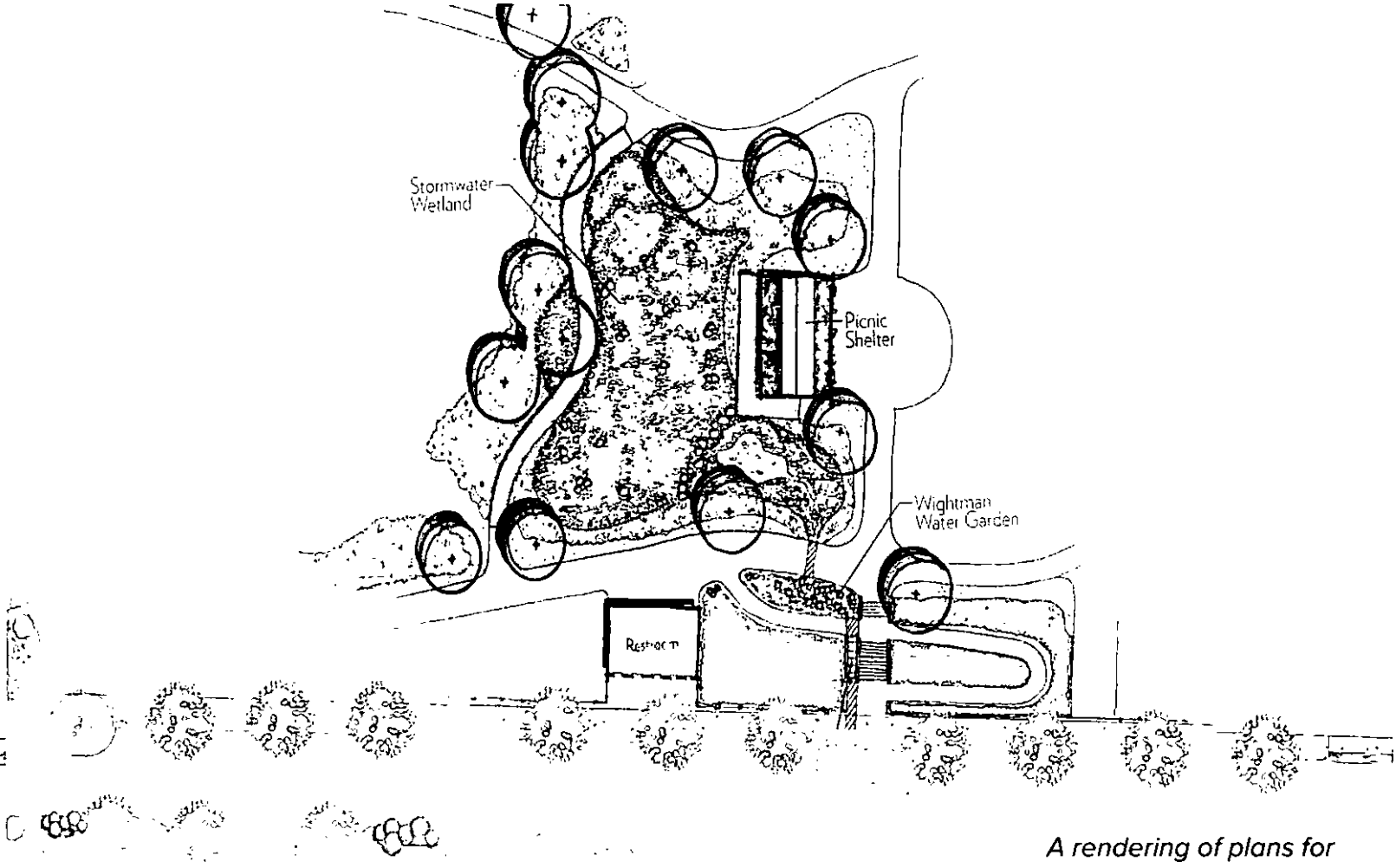
The project will decrease nearby surface and basement flooding. It will also reduce the amount of sediment and debris that often blocks the combined sewer system.

As part of this project, PWSA will determine the feasibility of providing a new stormwater outfall to convey stormwater flows directly to the Monongahela River via South 18th Street instead of relying on the combined sewer system.

This project is currently in its planning and design phase and is estimated to cost $8.7 million.

Stormwater infrastructure project at Centre and Herron in the Hill District





A rendering of plans for Wightman Park

WIGHTMAN PARK

Through a public process that started in 2014, community members helped develop a master plan the final design for an improved Wightman Park. The planned improvements create a safer, cleaner, greener, and more accessible space for the public to enjoy.

PWSA is incorporating the stormwater components of the Wightman Park Master Plan to improve drainage and combat stormwater issues in the surrounding area.

The stormwater components will redirect stormwater flow from adjacent streets into systems in the park and store stormwater in retention tanks during large storm events.

Additionally, the site will be regraded to improve the flow of stormwater and includes green infrastructure solutions including an infiltration pond and rain gardens.

Construction is anticipated to begin in 2019 and it will manage 5.4 million gallons of runoff per year.

The design cost is $2.4 million.

MARYLAND AVENUE

The Maryland Ave Stormwater Project will consist of distributed green stormwater infrastructure systems in four targeted areas within the Shadyside neighborhood. This area is one of the city's largest contributors of combined sewer overflows within the combined sewer system.

Additionally, this project will help to alleviate the widespread occurrences of basement backups and street flooding throughout the neighborhood.

Design costs for this project is approximately $11 million.

SEWER

Sewers are the often "out of sight, out of mind" work horse of a functioning water infrastructure system. We usually don't think much about sewers until something goes wrong with them. That is why for so many decades, we took for granted that the sewers that were built generations ago would last forever. We know now that is not the case, so we are prioritizing rebuilding key sewers and outfalls.

SEWERS UNDER STRUCTURES

As Pittsburgh grew, many of its buildings and bridges were constructed over existing sewer infrastructure. Now, due to aging pipes and limited accessibility, there has been an increasing rate of failure of these critical assets. PWSA is investing $6.7 million in the next few years to rehabilitate, relocate or reroute sewer lines located under buildings and bridges or adjacent to steep slopes that are prone to landslides.

Replacing this infrastructure will make our sewer system more resilient and reduce the likelihood of property damage, costly emergency repairs, and service outages.

SMALLMAN STREET WATER AND SEWER IMPROVEMENTS

In early 2018, PWSA began one of its most visible infrastructure projects – replacing the water and sewer lines along Smallman Street between 16th and 21st Streets. These pipes, over 100 years old, were located under the existing Produce Terminal. To avoid service disruptions and emergency repairs, PWSA began construction to replace this aging component of our water and sewer system before it failed, benefiting the investments in the area.

The project also meets requirements set by the Environmental Protection Agency to replace, where practical, combined sewer systems with systems that separate stormwater and wastewater.

The Strip District is one of Pittsburgh's most active business districts and it is a popular destination for locals and visitors alike. PWSA proactively coordinated construction with affected businesses and City departments to minimize construction disruptions.

This $13 million project is on schedule and under budget. It will result in over 7,000 feet of new water lines, storm sewer, and sanitary sewers, while improving water quality and the reliability of our water, storm, and sewer system for the next 50-100 years.

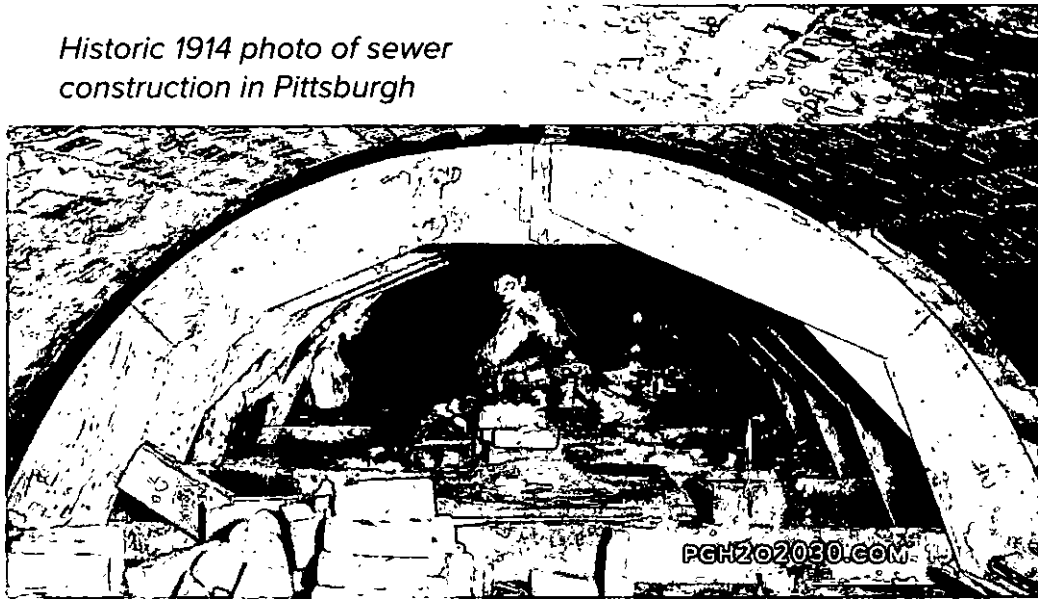
MAYTIDE STORM AND SANITARY SYSTEM IMPROVEMENTS

Localized property and street flooding are well-documented at the intersection of Maytide Street and the Sanderson City Steps in the Carrick and Overbrook neighborhoods. Topography, a lack of investment, and poor street maintenance cause unsafe conditions during severe storms.

PWSA is designing a project that will replace sanitary and storm sewer infrastructure on portions of Merrit Avenue, Sanderson Avenue, and Maytide Street to manage flows during storm events.

This project is currently in its design phase and is estimated to cost $6.2 million.

Historic 1914 photo of sewer construction in Pittsburgh



THANK YOU:

Thank you for reading our plan for Pittsburgh's water future. Many of these projects are a work in progress and subject to change over time. We know that the future is bright at PWSA and look forward to serving you through 2030 and beyond.

PHOTO CREDITS

Page 2 – Courtesy of Getty Images, girl at PPG Fountain

Page 3 – Courtesy of PWSA, fishing in Highland Park

Page 4 – Courtesy of PWSA, Community Event, Highland Park Reservoir, and a PWSA customer

Page 10 – Courtesy of PWSA, (top to bottom, left to right), top row: Lanpher Reservoir during construction, Second row: Stormwater project at Centre and Herron, inside the Highland Park Microfiltration Plant, Construction on Smallman Street, Third row: inside the Highland Park Microfiltration Plan, the Garfield Water Tower.

Page 11 – Courtesy of PWSA, (top to bottom, left to right), top row: Construction on Smallman Street, outside of the Highland Park Microfiltration Plant, Second row: inside the Highland Park Microfiltration Plan, a Stormwater manhole cover, outside the Water Treatment Plant in Aspinwall, Third Row: Highland Park Reservoir.

Page 12 – Courtesy of PWSA, a PWSA customer

Page 13 – Courtesy of PWSA, construction on Smallman Street

Page 14 – Courtesy of PWSA, a rendering of upgrades to the Aspinwall Water Treatment Plant

Page 15 – Courtesy of PWSA, inside the Highland Park Microfiltration Plant

Page 16 – Courtesy of Getty Images and PWSA, community members planting a rain garden

Page 17 – Courtesy of PWSA, rain garden at Centre and Herron

Page 18 – Courtesy of PWSA, rendering of stormwater work at Wightman Park

Page 19 – Courtesy of PWSA archives, Historic photo of a sewer tunnel under construction, 1914

See more photos from PWSA's historic archives and today at pgh2o2030.com



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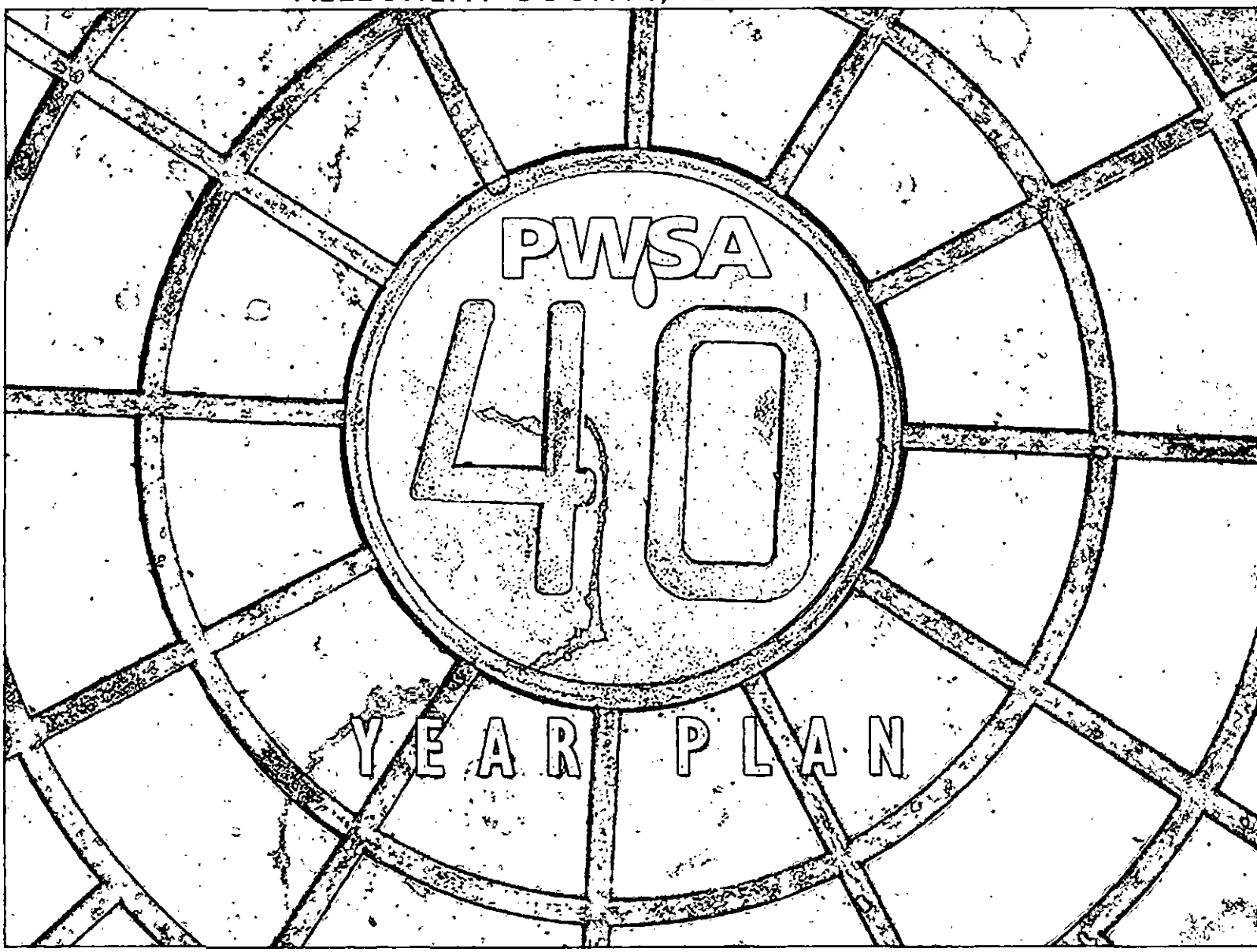
THE PITTSBURGH WATER & SEWER AUTHORITY

ALLEGHENY COUNTY, PENNSYLVANIA



SEPTEMBER 2012

CHESTER ENGINEERS, INC.

The Pittsburgh Water and Sewer Authority
Allegheny County, Pennsylvania

40-Year Plan

May 2011
Revised September 2012

Prepared by: Michael M. McKee, P.E.
John M. Maslanik, P.E.

Approved by: Charles J. Jordan, P.E.

Project No.: 10-3549-40 Year

PWSA Project No. R-D1.10015-11

CHESTER ENGINEERS

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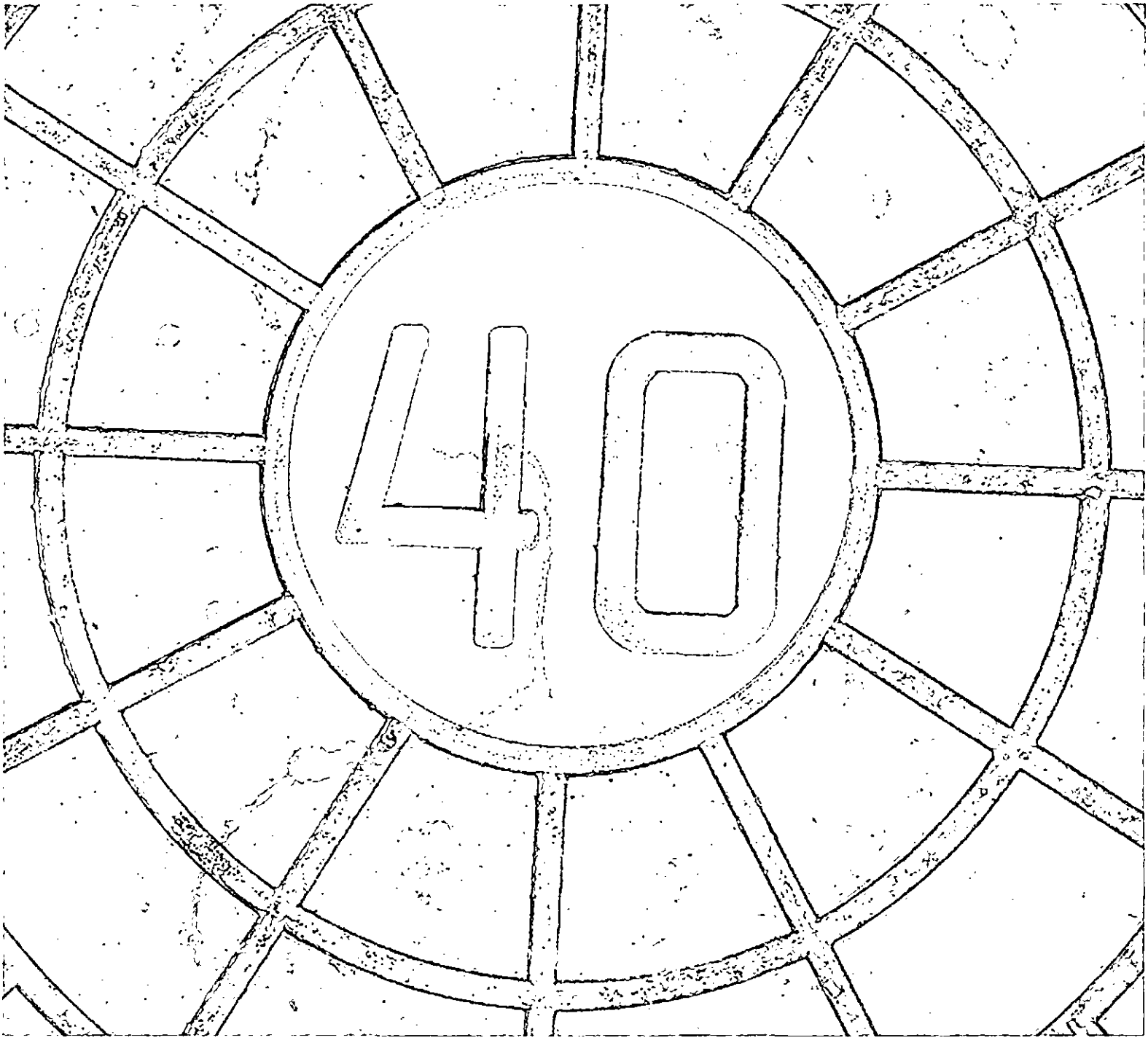

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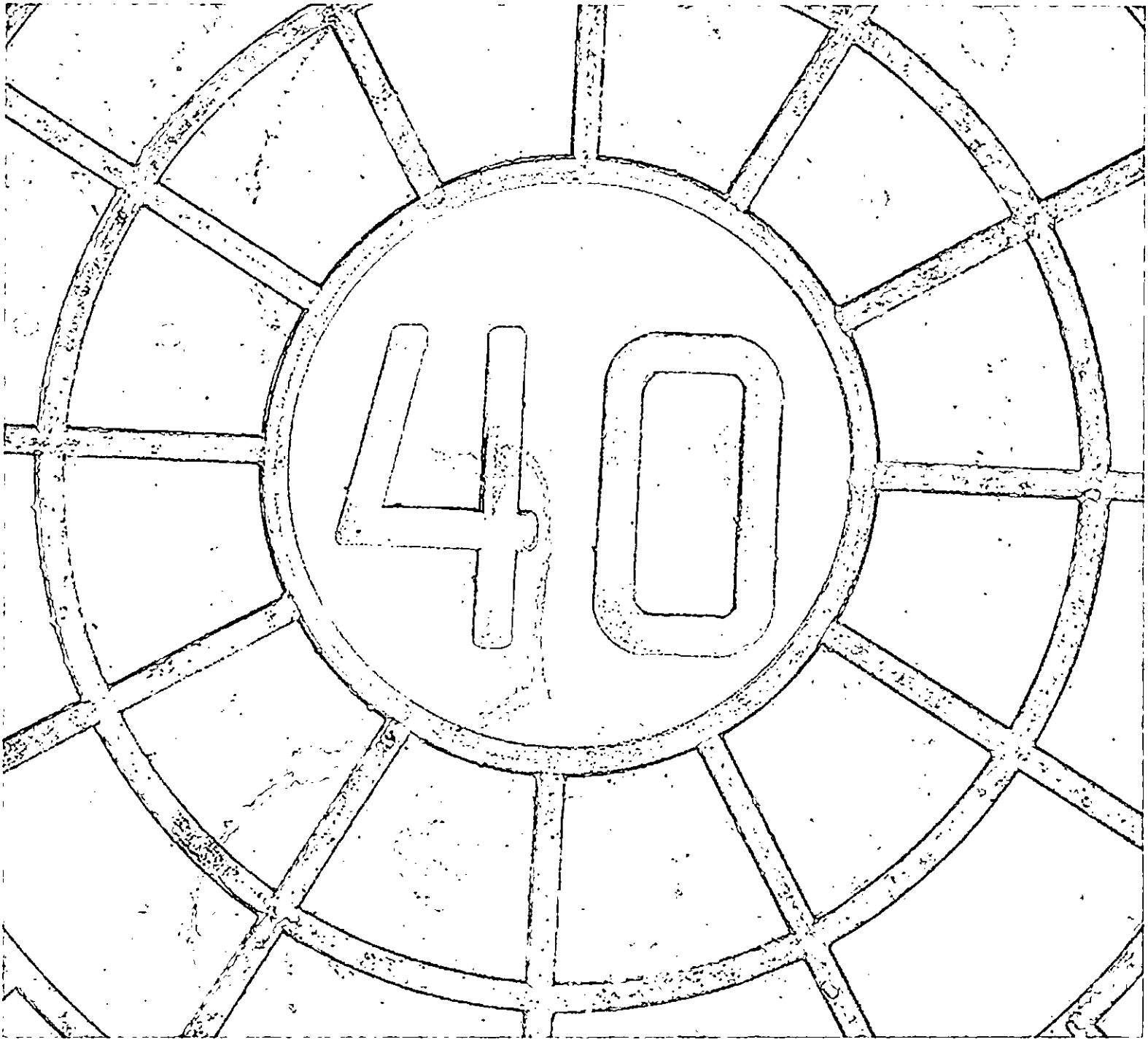
EXECUTIVE SUMMARY



CHESTER ENGINEERS, INC.

PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR PLAN
EXECUTIVE SUMMARY

In June 2010, PWSA issued an RFP for the preparation of a 40-Year Capital Plan and Water and Sewer Master Plan. The PWSA Board, upon recommendation of the PWSA staff, awarded the project to Chester Engineers.

The 40-Year Plan is a road map for the future that estimates the financial resources needed for capital improvements to the PWSA system. The Plan identifies upgrades to maintain and enhance the performance of the PWSA water and sewer systems. The Capital Improvement Program (CIP) is a series of eight 5-year plans that address repair and replacement needs. The capital plans provide PWSA with the tools to tackle the issues and to meet business objectives, maintain regulatory compliance, and address operational needs within the framework of practical capital funding capabilities. The plan will enable the PWSA Staff and Board to plan future rate adjustments and develop capital borrowing needs. Findings and recommendations are summarized below.

Potential Acquisitions

An analysis of the 40 public water suppliers in Allegheny County concluded that potential expansion of the PWSA water system through acquisition or water sales is limited to Etna Borough, Sharpsburg Borough, and the portion of the City that is currently served by Pennsylvania American Water Company. Etna and Sharpsburg could be served via existing PWSA interconnects but significant capital expenditures would be required to serve the South Hills portion of the City of Pittsburgh.

There are 23 neighboring communities whose wastewater passes through the PWSA system on the way to ALCOSAN for treatment. Because of the unknown costs of upgrading sewer systems to meet COA requirements, assuming ownership of a sewer system would have to be considered a liability. Excluding these concerns, the best candidates for regionalization would have sewer systems in good condition with considerable customer populations and no significant COA issues. The sewer systems in Green Tree Borough and Brentwood Borough meet these criteria.

System Inventory

System inventories were prepared in Excel spreadsheet format for all identified water and sewer system components. The collected information summarizes the age, type, and general condition of PWSA facilities. Treatment facilities include the 117 mgd capacity water filtration plant at Aspinwall and the 26 mgd capacity membrane filtration plant at the Highland No. 1 reservoir. There are 12 water pumping stations in the PWSA system,

excluding the Ross pump station which supplies raw water to the Aspinwall treatment plant. Water storage facilities include 4 in-ground reservoirs and 12 above-ground storage tanks. Above-ground storage facilities include 10 ground level tanks or standpipes and two elevated tanks. Three of the four reservoirs have floating covers. Highland No. 1 reservoir is not covered, so all the water that passes through this reservoir must be re-treated by the membrane filtration plant before it is distributed to customers. Summary statistics for the PWSA water distribution system are listed below:

- 5,341,000 linear feet or 1,012 miles of waterlines, 1-inch to 120-inch diameter.
- 25,330 valves.
- 7,558 hydrants.
- 3/4 of pipelines in system are 6, 8, and 12-inches in diameter.
- Oldest pipes and valves date back to 1887.

Statistics for the PWSA sewer system are summarized below:

- 6,395,000 linear feet or 1,211 miles of sewers, 3-inch to 168-inch diameter
- 29,084 manholes
- 24,143 catch basins/inlets
- 99 diversion structures
- 4 sewage pump stations
- Oldest sewers date back to 1900

System Valuations

A Replacement Cost New Less Depreciation analysis was conducted to determine system valuations. This type of analysis estimates how much it would cost to construct new facilities today and then adjusts replacement costs for individual facilities to account for their age via straight line depreciation. Estimated replacement costs and depreciated values for PWSA facilities are summarized below:

Category	Replacement Cost	Depreciated Value
Distribution	$708.05 million	$169.70 million
Treatment	262.26 million	129.15 million
Pumping	49.83 million	20.46 million
Storage	226.97 million	167.35 million
Water System Subtotal	1.25 billion	486.66 million
Sewer System	1.26 billion	287.27 million
Total	$2.51 billion	$777.93 million

Future Water Needs

Future treatment, pumping, storage, and distribution needs were determined using the PWSA water distribution system model. These evaluations were performed using 2051 water demands, which are expected to be about 8 percent higher than current levels.

Results of the distribution system capacity analysis indicate that no major new water main transmission projects are required to meet anticipated future demands.

The nominal capacities of the pump stations exceed projected future maximum day demands, indicating sufficient pumping capacity. However, additional pumping capacity is recommended at the Lincoln pump station in order to reduce demands in the Herron Hill District.

The PWSA system has an overall surplus of water storage capacity but deficits in storage capacities under future demand conditions were identified in several areas. It is recommended that the capacities of the Herron Hill and Garfield tanks be increased, and that the Squirrel Hill tank be replaced with an elevated tank. Additional storage capacity is also needed in the Lincoln District to lower demands in the Herron Hill District.

Based on current and projected future water demands, no additional treatment capacity is required but it is recommended that PWSA apply for an increase in the permitted water allocation from 100 to 117 mgd.

Sewer System Needs

The PWSA Feasibility Study provides preliminary recommendations relative to projects needed to control CSO discharges from PWSA facilities. PWSA customers will share in the costs for improvements to the jointly permitted outfalls but PWSA will only have to finance capital costs for improvements related to its own CSO outfalls.

The improvements described in the Draft Feasibility Study were reviewed with PWSA staff to identify and refine the improvements needed to control overflows from CSO outfalls that are permitted to PWSA only. PWSA's share of costs for all the CSO improvement projects is estimated to be $195.16 million. This is a very preliminary estimate that is subject to change pending finalization of the PWSA Draft Feasibility Study and regional wet weather planning efforts. Remaining costs are to be covered by contributions from tributary communities that make use of PWSA sewers to convey their wastewater contributions to the ALCOSAN system.

Pumping and Treatment Inventory

An inventory of major PWSA pumps and equipment was developed that includes pumps and equipment at water pumping stations, the Highland membrane filtration plant, the Aspinwall water treatment plant, and at the four sewage pumping stations. The inventory presents information about the pumps and equipment located at each PWSA facility. Information on the list includes equipment name or brief description, equipment

manufacturer, model / serial number, capacity, number of units, date installed, age of unit, and general condition based on appearance and input from PWSA staff.

Waterline Risk Based Analysis

A significant percentage of the water mains in the PWSA system are more than 70-years of age, a generally accepted estimate of the useful life of cast iron mains. Aging pipes become increasingly vulnerable to structural failures and are plagued by water main breaks of increasing frequency and severity, excessive leaks, and catastrophic failure resulting in large water losses, flooding, property damage, and community disruption. These issues can be addressed through the implementation of an ongoing water main repair and replacement program. Water main replacements have been a part of capital improvements programs in the past. However, to be effective, the 40-Year capital plan must include a substantially more aggressive water main replacement program that is supported by a decision support system that can better target mains for replacement and provide a tool for CIP planning.

As part of the development of the 40-year plan, the CapPlan software was used to develop a risk based water main replacement/rehabilitation program. The basic concept is that investments in water main replacement/rehabilitations should be targeted to most effectively minimize risk to the system. The software was used to calculate the risk associated with each pipe segment as the consequences of failure score multiplied by the probability of failure score. The computed risk provided the measure used to prioritize specific water main segments for replacement/rehabilitation.

The CapPlan program was used to develop a budget for replacing/rehabilitating all pipe segments that the program identified as having medium to high risk of failure. Pipe segments identified as having a low to negligible relative risk were not scheduled for replacement/rehabilitation during the 40-year planning period. In order to rehabilitate/replace the medium to high risk mains, the program determined that approximately $14.8 million per year (project cost in current dollars) will have to be spent over the next 40 years.

Leak Detection and Repair

The following activities are recommended for PWSA to institute a comprehensive and efficient leak detection program:

- Calibrate venturi meters at the treatment plant and pump stations to provide accurate figures for the amount of water produced and entering the distribution system.
- Break down the water system into subareas based on the locations of the venturi meters.

- Determine the total metered consumption in individual subareas.
- Compare the amount of water delivered to each subarea versus the amount of water consumed to determine apparent water losses.
- Rank the subareas from worst to best in terms of apparent water losses.
- Use leak detection contractors to find leaks in larger lines and PWSA crews to survey leaks in smaller lines.

Leak detection and repair efforts should focus on subareas identified as having the highest rates of apparent water losses to maximize results. The PWSA GIS can also be used to compare flow rates and metered usage to quantify non-revenue water losses on a near real-time basis. Most customer meters are equipped with an automatic meter reading feature that can be used to determine water use in 15 minute increments. If the water system subareas are broken down into smaller sections for further analysis, zonal system metering can be used in conjunction with automatic meter reading of customer usage to help determine leaks in the distribution system.

Cost Estimates

Concept level cost estimates were developed for recommended capital improvements. The improvement projects are broken down into eight- five year plans to provide the PWSA with a plan of action to meet business objectives, maintain regulatory compliance, and address operational needs within the framework of practical capital funding capabilities. Each capital improvement project is grouped according to business area.

Distribution

Distribution system improvements include the following components:

- Replacement of pipe segments with medium to high risk of failure.
- Leak detection on larger lines by outside contractors.
- Water meter replacement program.
- Millvale water system improvements to increase pressure.
- Facilities to transfer water from Highland No. 2 District to Highland No.1 District.
- Bloomfield-Penn Avenue distribution system improvements.
- Reducing the size of the Herron Hill service district.
- Joint venture projects.

The cost for the recommended distribution system improvements is estimated to be $1.405 billion over the 40-year planning period.

Pumping and Storage

Pumping improvements include replacement of pumps, roofs, motor control centers, and HVAC systems. Storage improvements include repair and replacement of floating reservoir covers, reservoir cleaning, tank painting, concrete tank repairs, tank replacement, and installation of systems to reduce TTHMs in water storage tanks. The estimated cost for improvements over the 40-year planning period is $35.018 million for pumping upgrades and $150.652 million for storage related projects.

Treatment

Treatment improvements include rehabilitation of sedimentation basins, clarifiers, filters, the clearwell, and chemical feed systems. Other improvements include SCADA upgrades, replacement of motor control centers, pumps and motors, and the boiler at the Ross pump station. The estimated cost for recommended treatment improvements is projected to be $401.607 million over the planning period.

Sewers

Sewer improvements include COA projects, sewage pump station upgrades, and joint venture projects with the URA and other agencies. Expenditures include $1.00 million per year for COA compliance and a $2 million annual allowance for other sewer system improvements. The cost for recommended capital improvements to the sewer system over the 40-year planning period is estimated to be $604.995 million.

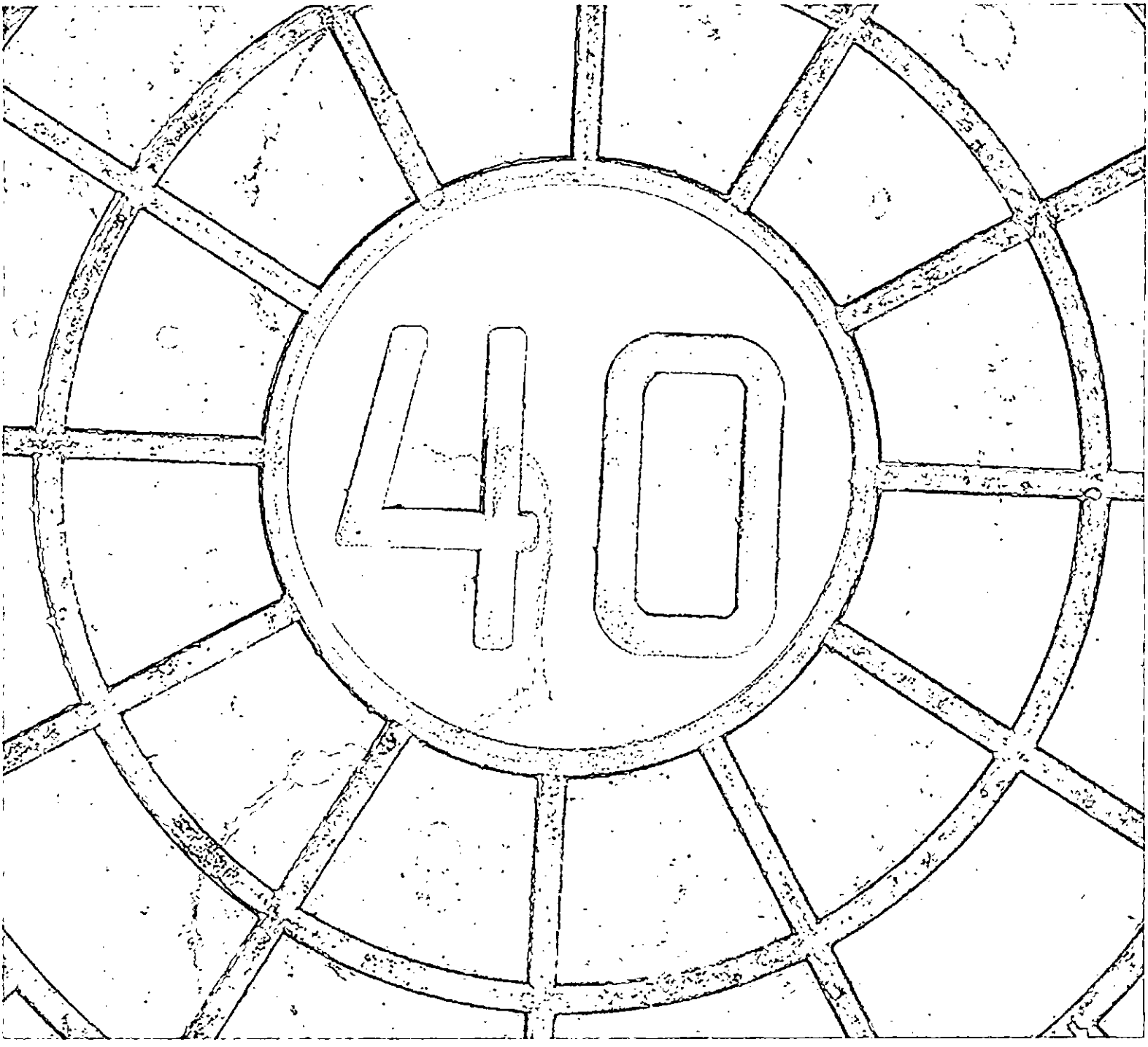
GIS

The estimated cost for GIS capital improvements is estimated at $2.10 million over the planning period. Items under this category include GPS units, laptops for field crews, software upgrades, and server upgrades.

Total Costs

The total cost for system improvements over the 40-year planning period is estimated to be $2.60 billion. Distribution system improvements account for about 54 percent of the total. Expenditures for recommended capital improvements during the eight, five-year plans range from $242 to $408 million and average $325 million or $65 million per year.

TASK 1



PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR PLAN
TASK 1 - PROJECT COORDINATION/REVIEW MEETINGS

1.1 PROJECT KICKOFF MEETING

A project kickoff meeting was held on October 5, 2010 with key PWSA personnel. Items discussed at the meeting included project organization, communications, project tasks, project schedule, and project objectives. The roles of Chester Engineers team members and PWSA staff were identified and communication protocols were established. The work tasks described in Chester's proposal were reviewed to ensure that the proposed work scope and schedule were in alignment with the PWSA's goals and objectives. Specific project objectives were also discussed during the kick-off meeting.

More detailed information about the kick-off meeting is available in the meeting minutes. Minutes for the kick-off meeting are included in Appendix 1-1.

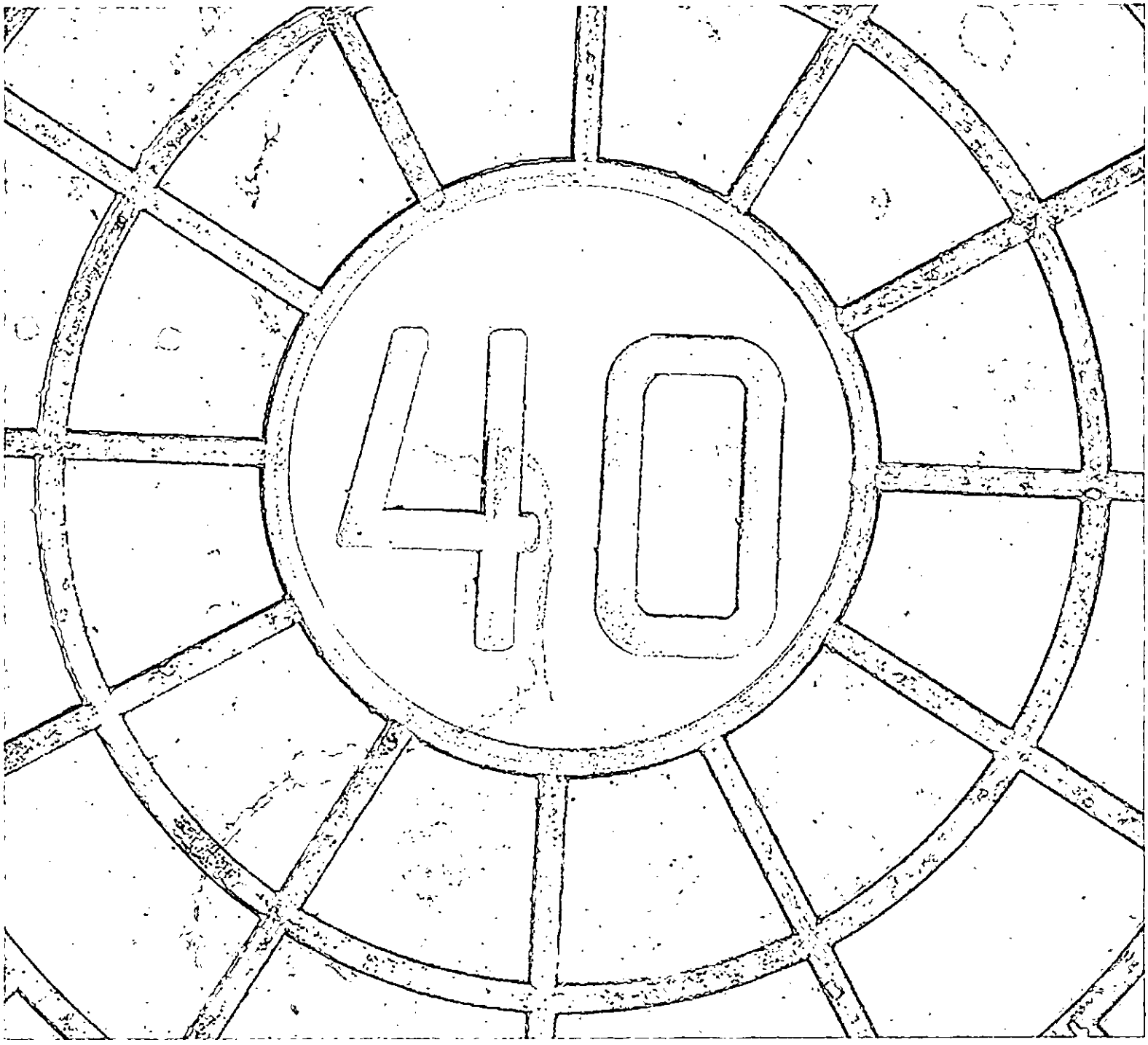
1.2 MONTHLY PROJECT MEETINGS

Progress meetings were held at approximately one-month intervals. Agendas were developed prior to the meetings and minutes were produced afterwards to document the subjects covered at the meetings. General discussion topics for the meetings included preliminary findings, updates of progress versus schedule, and identification of potential alternatives. The meetings were also used to solicit input from PWSA staff regarding sources of available information, evaluation of alternatives, and prioritization of improvements.

More detailed information about the monthly progress meetings can be found in the meeting agendas and meeting minutes. Meeting agendas are included as Appendix 1-2 and meeting minutes are contained in Appendix 1-3.

An internal questionnaire was also developed and distributed to PWSA. The purpose of this questionnaire was to obtain input from PWSA department heads and other key staff members on items that needed to be addressed in the 40-Year Capital Plan. A meeting to discuss the internal questionnaire was held on October 29, 2010. A meeting agenda and completed questionnaires are included in Appendix 1-4.

TASK 2



THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR PLAN
TASK 2 - IDENTIFY OPPORTUNITIES FOR REGIONALIZATION

2.1 GROWTH INITIATIVES AND REGIONALIZATION

Meetings were held with representatives of the City of Pittsburgh Department of City Planning, the Allegheny County Department of Economic Development, the Allegheny County Health Department (ACHD), and the Pennsylvania Department of Environmental Protection (DEP). Summaries of the items discussed at each individual meeting can be found in Appendix 2-1.

The meeting with the Department of City Planning was held on May 4, 2011. Most of the meeting was spent discussing what City Planning has observed regarding historic development trends and where future land use changes are expected within the City. Projections indicate that the City's 2035 population is expected to stabilize between 330,000 and 335,000 persons.

A meeting was held on May 5, 2011 with the Allegheny County Department of Economic Development. Information was provided on two new hotel developments, one Downtown and one in Oakland, that are expected to be completed in 2013. The remainder of the meeting was spent reviewing activities that the Department has been involved with, specifically related to development trends and the City. These activities and studies include Allegheny Places, Connect, Allegheny Together, ARTEZ, and comprehensive water and sewer plans for Allegheny County.

The meeting with ACHD was held on May 10, 2011. The majority of the meeting was spent discussing conditions that the ACHD sees in the field and the type of complaints that are received. ACHD receives very few complaints about the PWSA water system but the age of the existing infrastructure is a concern. On the sewer side, combined sewer overflows are a concern and the ACHD estimates that approximately 500 homes in the City of Pittsburgh are served by private septic systems and are not connected to the public sewer system.

The meeting with the DEP was also held on May 10, 2011. Discussions primarily focused on expected future trends in Pennsylvania air and water regulations but Marcellus shale issues and Brownfields redevelopment were also discussed. DEP representatives noted that regionalization opportunities exist with surrounding communities including Reserve, Aspinwall, Fox Chapel, Blawnox, and Millvale.

2.2 REGIONALIZATION REVIEW

Introduction

Definition: Regionalization

- Expanded service areas that take in a larger geographic area or multiple systems.
- Multi-jurisdictional utility commissions, special districts, authorities or corporations.
- Consolidated operation or management of multiple systems or onsite systems.
- Merging, consolidating, or combining infrastructure assets of two or more existing facilities or systems.

Primary drivers for regionalization (not in any order of importance or priority):

- Changing water and wastewater rules and regulations.
- Reliability and capacity.
- Economies of scale.
- Financing.
- Shortage of qualified leadership, management or supervisorial talent and/or an adequate skilled trade labor force (e.g., retirement of "baby boomers").
- Consolidation of redundant administrative and governance functions.

Annually, the American Water Works Association (AWWA) reissues its Statement of Policy on Public Water Supply Matters with little if any modification since release of the 1996 Safe Drinking Water Act Amendments. In 2009, the reaffirmation of its policy read as follows:

> The American Water Works Association (AWWA) encourages water utilities to support regional solutions to resource management, water supply, and utility services needs (emphasis added). AWWA values the protection and efficient use of natural resources. Regional water supply planning may increase water use efficiency, promote water conservation, minimize capital investment, and enhance source protection. Where a regional program is necessary or desirable, water utilities should work with the appropriate governmental and other entities to develop regional solutions to promote effective water resource and water supply management practices coupled with sound provision of utility services (emphasis added). Furthermore, AWWA encourages state, provincial, territorial, and federal agencies to support local efforts to develop appropriate regional programs and to ensure equitable benefits to all participating water utilities.

> Regionalization of water source management and utility services, either through physical connection and/or common management structures, may provide enhanced source water protection and management practices and economies of scale (emphasis added). AWWA defines a regional water system as a management or contractual administrative organization, or a coordinated physical system plan of two or more community water systems using common resources and facilities to their optimum advantage, to provide sustainable water resource and supply management and high quality water service to customers in a fiscally responsible manner.
>
> The economic effect of regulatory reform, such as the 1996 Safe Drinking Water Act Amendments is significant. Utilities face additional monitoring and capital costs, and smaller water systems may struggle to cover costs associated with water resource and supply management requirements in their effort to provide high-quality water utility services. AWWA recognizes the importance of regional solutions that support local (community) needs and are consistent with effective resource management programs and practices. At the same time, AWWA emphasizes the need for utilities to operate as self-sustaining organizations whose management practices and structures are defined by local requirements (emphasis added). Accordingly, regional water resource and supply management and utility service programs and policies need to recognize and address the individual needs and requirements of local, state, provincial, and federal stakeholders.

In summary, the AWWA Statement of Policy:

- Encourages water utilities to support regional solutions to resource management, water supply, and utility services needs.
- Suggests where a regional approach is necessary or desirable; that water utilities should work with appropriate governmental and other entities to develop regional solutions to promote effective water resource and water supply management practices coupled with sound provision of utility services.
- Advises that regionalization of water source management and utility services, either through physical connection and/or common management structures, may provide enhanced source water protection and management practices and economies of scale.

With little modification, this policy can readily be applied as a policy statement for accomplishing regional solutions for water quality protection and wastewater management. However, relative to water systems, regionalization of wastewater systems has been particularly emphasized in the last 40 years under provisions of the Clean Water Act Amendments of 1972 ("the Act" [PL 92-500]) starting with grants for regional wastewater facility planning required by Section 201 of the Act. This planning preceded

tens of billions of dollars for design and construction grants for water pollution control facilities obligated into the 1980's and ultimately morphing into a sustained federal capitalized grant program under which states administer low interest capital loan programs, commonly know as State Revolving Funds. The wastewater industry has reaped the benefits of grant funding, which accelerated and expanded regional approaches to water quality and wastewater management across the nation.

Pennsylvania Statutes on Water Utility Restructuring and Consolidation Efforts

This section summarizes Pennsylvania statutes, regulations, or policies that encourage or require consolidation or restructuring (aka regionalization) of drinking water systems.

Overview of State Restructuring and Consolidation Efforts

State agencies directly involved with restructuring and consolidation efforts are primarily the Pennsylvania Public Utility Commission and the Pennsylvania Department of Environmental Protection.

Title 52 Pennsylvania Code (PC) Chapter § 69.701 addresses the viability of small water systems and presents objectives of the Public Utility Commission (PUC) and the Department of Environmental Protection (DEP) as "substantially restricting the number of nonviable drinking water systems by discouraging the creation of new nonviable small systems, and at the same time, encouraging the restructuring of existing nonviable small systems".

To meet these goals the PUC provides acquisition incentives, among other things, and facilitates the rate process to aid in the provision of financial assistance from PENNVEST, the state's finance authority, to projects that incorporate or encourage comprehensive planning and restructuring. The PUC has statutory authority to order, under appropriate circumstances, the acquisition of small, noncompliant water systems by larger systems that are capable of providing safe and adequate service to all ratepayers.

To be eligible for the incentives, an acquisition must: serve the general public interest; be conducted through arms-length negotiations; leave the acquiring system with adequate technical, managerial and financial capabilities; and provide the acquired system's rate payers with improved service within a reasonable period of time. In addition, the acquired system must be non-viable: in violation of a PUC statute or regulation; have failed to comply with a DEP order; and serve fewer than 3,300 customers. The purchase price of the acquisition must be fair and reasonable.

Acquisition incentives include additional rate of return basis points, the inclusion of reasonable excess acquisition costs in the rate base of the acquiring entity and amortization over 10 years, with a phased-in rate recovery for improvement costs. Additional surcharges are allowed to offset various operating costs (state tax adjustment, distribution system improvement, purchase power, and purchase water). The PUC encourages Single Tariff Pricing (STP) as an appropriate tool to facilitate regionalization.

Benefits of Regionalization

In general, benefits of regionalization are derived from the following:

- Economies of scale – larger pool of ratepayers to spread operating and capitalization costs.
- Consolidation of services – billing services, certified operators, and other administrative functions.
- Fewer numbers of treatment installations - leads to overall cost-savings to ratepayers (e.g., one centralized treatment plant to cover all demands).
- Access to capital and lower cost of capital – better loan terms and bond rates
- Natural resources management and watershed protection – better opportunity to manage a watershed holistically to accommodate multiple uses and interests.

System Operational Benefits

- Operation and Management – facilitate improvement of management by providing more comprehensive supervision and better day-to-day direction of operations. More effective and extensive monitoring of water quality on the basis of economies of scale; 1) assure optimum reaction to emergencies by unified service organizations, and 2) standardization of construction materials.
- Planning and Design – allow for optimum planning of water supply
- Financing – uniform water rate structure resulting from the cost of services being distributed over a larger geographic area and facilitating coordination and combination of fiscal and physical resources; assist in better short- and long-term financing terms because of the stability of the revenue base and better bond/credit ratings.
- Government – will assist the Pennsylvania Department of Environmental Protection (DEP) by reducing the number of management organizations needed to monitor water quality, and possibly the reduction in political entities involved in water system management. Well managed systems will reduce

the incidence of government interceding in the operation and control of water utilities.

Potential Problems/Drawbacks

- Public Attitude and Government – communities may be opposed to loss of control of its water system's income diverted to a regional general fund. May be indifferent to water needs and the risk posed by inaction. Municipalities cannot readily be compelled to join a regional agency.
- Inequities and financing – concern for loss of water sales revenue used for other general purpose needs; may be difficult to purchase a private system or acquire properties of another utility by condemnation. Concern that water revenues from a well serviced area will be used to finance improved supply to a poorly serviced area.
- Reorganization – reduction in staff; may shift highly qualified personnel into incompatible positions for their skills; organized labor issues.

Regionalization "Lite"

Drinking water and water quality rules and regulations have historically, at least in part, driven regionalization or other cooperative efforts among agencies. While these rules undoubtedly have raised the cost of doing business, funding agencies tend to look more favorably toward projects that have some characteristics of a regional approach. Implementation of existing rules through voluntary and enforcement actions, and the advent of new rules and regulations on the horizon and beyond will dictate the need for continuing and expanded cooperation. Such relatively recent or emerging areas of regulation include:

- Surface Water Treatment.
- Disinfectants and Disinfection Byproducts.
- Personal Hygiene Products.
- Endocrine blockers and other pharmaceuticals.
- Other micro contaminants.

However, there are alternatives to complete consolidation and regionalization of service providers such as interconnection for purposes of supplying wholesale treated and untreated bulk water; providing emergency backup capacity; providing mutual aid; and sharing other resources/assets including offices, and management and operational personnel, while maintaining separate governing bodies. These alternatives should be carefully considered in the overall scheme of regionalization concepts and approaches.

Barriers to Regionalization

A series of listening sessions were held in the state of Idaho to document perspectives on regional approaches to providing drinking water and sanitary sewer services. One consistent theme emerged from these discussions - the desire to maintain jurisdictional autonomy regularly outweighs the potential benefits of participating in regional approaches involving shared capacity and governance. Participants felt that decisions on how best to manage water and wastewater provisions are most effectively carried out on a local, case-by case basis. Further, individual communities were reluctant to give up their ability to control the pattern and pace of development within their jurisdictions.

Potential barriers to the adoption of regional approaches to water and sewer provision are listed below:

- History of disagreements / political posturing by neighboring communities.
- Differing priorities and opinions on appropriate service levels.
- Differing public financing philosophies - pay as you go versus bonds.
- Potential loss of control over how resources will be deployed - one community will be required to pay for the needs of another community.
- Concern about unequal allocation of shared resources between jurisdictions - smaller community won't benefit from the shared arrangement.
- Concern about a lack of access to the capacity needed to support growth opportunities.
- Potential loss of control regarding the nature and rate of development within the community.
- Regional approach adds bureaucracy and costs to an already complicated system.
- Concern about the loss of community identity if resources are shared.
- No compelling reasons to change – inertia, no significant problems with current system.

Use of Eminent Domain to Purchase Water Utilities

The use of eminent domain to provide for public utilities such as light, heat, water, and power is widely recognized. However, the governing statutory provisions in most states usually do not expressly provide that eminent domain can be used to acquire an existing utility. The practice of public condemnation of private utilities dates back to the mid-19th century. The practice is generally accepted historically, with courts uniformly finding that obtaining public ownership of utilities is a sufficient public purpose to support the exercise of eminent domain. In the past half-century, there is more division on the issue.

with some states encouraging condemnation by statute and other states limiting it. A few states require a finding of "necessity" as a pre-condition for exercising eminent domain. In the condemnation of an existing utility, it is possible to argue a lack of necessity since the public already is being served by the private utility.

The cities of Pekin and Peoria, Illinois have been separately engaged in legal struggles with Illinois American Water, an investor-owned utility, over purchasing the utility assets. Peoria's right to purchase private assets was established under an old contract through which they sold public assets to American Water's predecessor. The courts upheld the repurchase clause in the contract, although American Water disputed it. Ultimately, Peoria chose not to re-purchase the American Water assets because they were deemed too expensive.

Unlike Peoria, the City of Pekin has no such contractual history with American Water. Pekin has attempted to use eminent domain to purchase the private assets and this action is currently being litigated. Illinois is among those states that limit local authority, although not over a finding of necessity. Instead, the Illinois Commerce Commission has established a standard that the condemnation must be in the public interest. Pekin has floundered on this standard and in particular has not addressed the issue of rate protection for water system customers outside Pekin City limits.

Privately owned utility companies fear such government ownership and have resisted selling their assets to cities, arguing that public ownership will not provide the promised reliability, adequate customer service, or reduced prices. This is precisely the argument made successfully so far by Illinois-American Water versus the City of Pekin.

Advancing Regionalization and the Human Factor. Blockers, Dos and Don'ts

Potential adverse human reaction to the suggestion of regionalization should be anticipated in order to preserve the integrity of the option and ultimately manage its implementation successfully. Several of the more common reactions include the following:

- Concerns about losing autonomy, loss of control or power by one group or another, or not being able to control their own destiny.
- If the people involved believe that something is being forced upon them and they cannot see a direct benefit to the community, opposition is generally the outcome.
- It is important that local elected officials do not allow their own personal agendas to influence their decisions. It is essential for those who are involved in the process to be involved for the right reason -- the overall good of the community.

Advancing Regionalization

- Good communication – participants must not feel threatened or forced into hasty decisions; well designed and executed public participation is strongly advised.
- Strong leadership – need to keep moving the dialog forward; supply the diplomacy and communications needed to garner the support required to advance the project.
- Customer confidence – merger has to resolve problems obvious to the ratepayers and undeniably improve efficiencies of operations while meeting a represented level of service.
- Common agendas – differences have to be minimized if not eliminated in order to achieve unity and a spirit of cooperation

Responsibility of the Community in Considering Regionalization

Regionalization is linked to capacity development and helping drinking water and sewer systems improve their finances, management, infrastructure, and operations so they can provide safe drinking water and water quality protection consistently, reliably and cost effectively. In that context, communities should answer the following before proceeding with long-term regionalization efforts:

- Will the community or public be better served by the new system?
- What are the added benefits that the community will receive from this new entity?

2.3 EVALUATE WATER SYSTEM EXPANSION OPTIONS

Public water service in Allegheny County is provided by the 40 water suppliers listed in Table 2-1. Public water suppliers include 23 authorities, 16 municipalities, and 1 investor owned utility. Areas of Allegheny County served by these water suppliers are illustrated in Figure 2-1. PWSA acquired the Millvale water system in 2009.

Table 2-1
Allegheny County Public Water Suppliers

Supplier	Type of Ownership	Primary Source of Water
Aleppo Township Authority	Authority	Purchased
Aspinwall Borough Water Department	Municipal	Ground
Brackenridge Borough Water	Municipal	Surface

Table 2-1
Allegheny County Public Water Suppliers (Continued)

Supplier	Type of Ownership	Primary Source of Water
Blawnox Municipal Waterworks	Municipal	Purchased
Braddock Borough Water Authority	Authority	Purchased
Cheswick Borough Water Department	Municipal	Ground
Coraopolis Water & Sewer Authority	Municipal	Ground
Creswell Heights Joint Authority	Authority	Ground
City of Duquesne	Municipal	Purchased
East Deer Township Waterworks	Municipal	Purchased
Edgeworth Borough Municipal Authority	Authority	Purchased
Etna Borough	Municipal	Purchased
Fawn Frazier Joint Water Authority	Authority	Purchased
Findlay Twp Water Authority	Authority	Purchased
Fox Chapel Authority	Authority	Purchased
Glenfield Water Company	Municipal	Purchased
Hampton Shaler Water Authority	Authority	Ground
Harmar Township Municipal Authority	Authority	Ground
Harrison Township Water Authority	Authority	Surface
Monroeville Municipal Authority	Authority	Purchased
Moon Township Water Authority	Authority	Surface
Neville Township	Municipal	Purchased
Oakdale Borough	Municipal	Purchased
Oakmont Borough Municipal Authority	Authority	Surface
Pennsylvania American Water Company	Investor PUC	Surface
Pittsburgh Water & Sewer Authority	Authority	Surface
Plum Borough Municipal Authority	Authority	Purchased
Richland Township Municipal Authority	Authority	Purchased
Reserve Township	Municipal	Purchased
Robinson Township Municipal Authority	Authority	Surface
Sewickley Borough Water Authority	Authority	Ground
Borough of Sharpsburg	Municipal	Ground
Springdale Township	Municipal	Purchased
Springdale Borough Water Department	Municipal	Ground
Tarentum Borough	Municipal	Surface
Western Allegheny County Municipal Authority	Authority	Purchased
Westmoreland County Municipal Authority	Authority	Surface
West View Borough Municipal Authority	Authority	Surface
Wilkinsburg -Penn Joint Water Authority	Authority	Surface

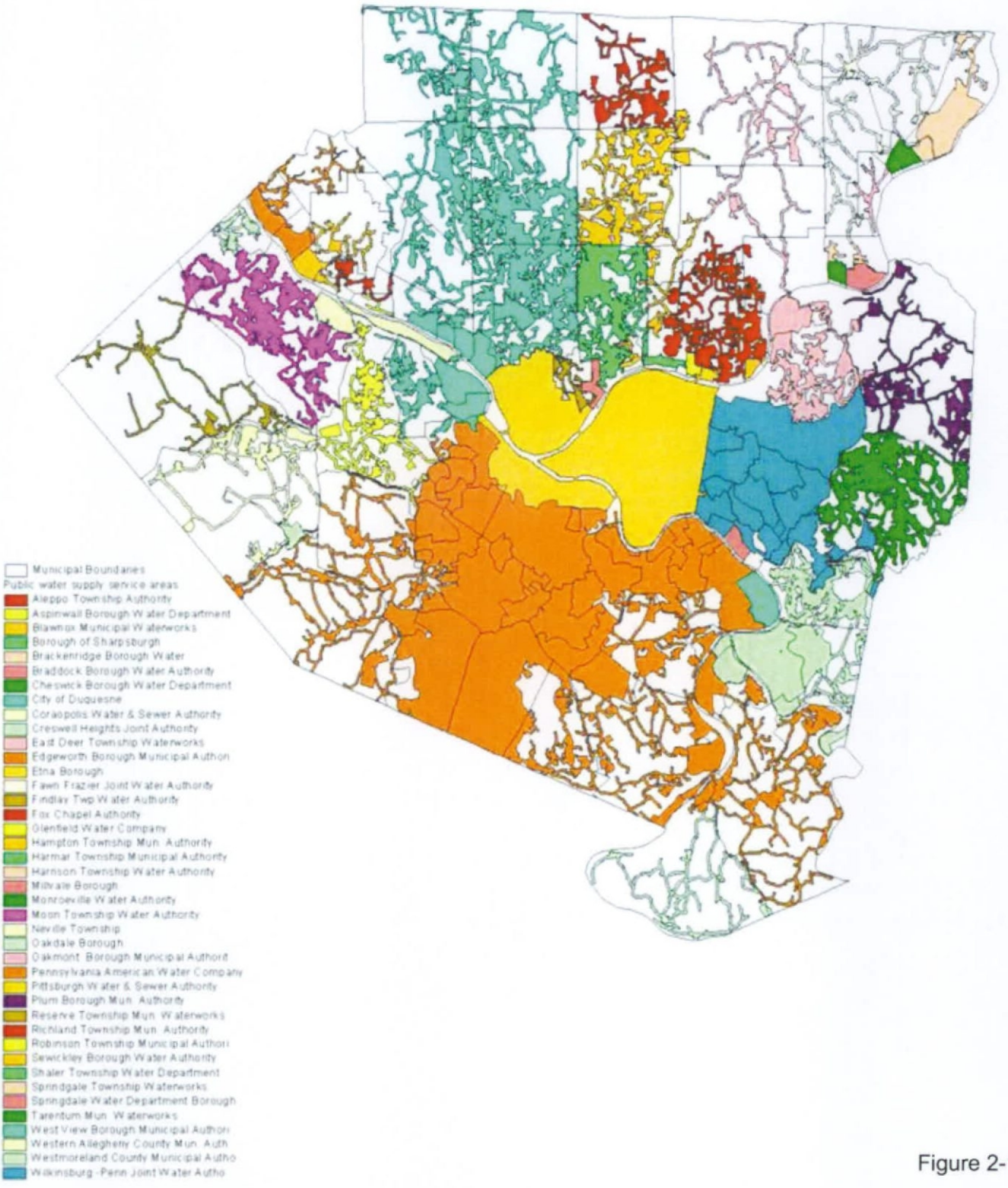

Municipal Boundaries
Public water supply service areas
Aleppo Township Authority
Aspinwall Borough Water Department
Blawnox Municipal Waterworks
Borough of Sharpsburgh
Brackenridge Borough Water
Braddock Borough Water Authority
Cheswick Borough Water Department
City of Duquesne
Coraopolis Water & Sewer Authority
Creswell Heights Joint Authority
East Deer Township Waterworks
Edgeworth Borough Municipal Author
Etna Borough
Fawn Frazier Joint Water Authority
Findlay Twp Water Authority
Fox Chapel Authority
Glenfield Water Company
Hampton Township Mun. Authority
Harmar Township Municipal Authority
Harrison Township Water Authority
Millvale Borough
Monroeville Water Authority
Moon Township Water Authority
Neville Township
Oakdale Borough
Oakmont Borough Municipal Authorit
Pennsylvania American Water Company
Pittsburgh Water & Sewer Authority
Plum Borough Mun. Authority
Reserve Township Mun. Waterworks
Richland Township Mun. Authority
Robinson Township Municipal Author
Sewickley Borough Water Authority
Shaler Township Water Department
Springdale Township Waterworks
Springdale Water Department Borough
Tarentum Mun. Waterworks
West View Borough Municipal Author
Western Allegheny County Mun. Auth
Westmoreland County Municipal Autho
Wilkinsburg - Penn Joint Water Autho

Figure 2-1

Water Requirements

Table 2-2 presents information about existing Allegheny County water suppliers. Numbers of customers and current water demands associated with each of the water service suppliers were obtained from annual water supply reports that are submitted to the Pennsylvania Department of Environmental Protection (DEP). Average day demands are most relevant to the assessment of the impact upon treatment system capacity and water sales revenue potential. Maximum day demands are the primary determining factor in sizing water system extensions and evaluating the impact of those extensions on the PWSA distribution system.

Existing Rate Information

Table 2-2 also presents existing rate structure information for each water supplier, including the base rate and the volumetric rate for water service. Rate information for four of the suppliers came from Internet web sites but the majority of the information was obtained via a telephone survey. Base rate information was only provided by about 50 percent of the suppliers contacted during the telephone survey. The Glenfield Water Company did not provide any information. Some water providers bill their customers on a quarterly basis while others send bills each month. Similarly, some providers send bills based on the number of gallons used while other bills are based on cubic feet of water consumed. To be consistent and allow comparisons to be made, all base rates were converted to a cost per month and all volumetric rates were converted to a cost per 1,000 gallons.

Potentially Feasible Candidates for Regionalization

Regionalization with many of the 39 other public water suppliers that operate in Allegheny County is not feasible for various reasons including the size of the County, distances from PWSA facilities, small service populations for some suppliers, and political considerations. Allegheny County has a total area of about 745 square miles. At its widest points, the County measures approximately 33 miles in a north-south direction and 34 miles from east to west. The PWSA service area is located in the geographical center of the County, making it impractical to extend service from the PWSA system to distant water suppliers. The following 15 public water suppliers are situated at the outer edges of Allegheny County and are adjacent to neighboring counties:

- Brackenridge Borough Water
- Creswell Heights Joint Authority
- East Deer Township Waterworks

Table 2-2

Public Water Supplier Information

	Supplier	Ownership	Water Source	No. of Customers	Avg. Day Demand	Max Day Demand	Base Rate $/Month	Water Cost $/1,000 gal
1	Aleppo Township Authority [2]	Authority	Purchased	647	184,193	N.A.	$7.72	$6.00
2	Aspinwall Borough Water Department [1]	Municipal	Purchased	1,201	232,164	257,500	N.P.	6.61
3	Brackenridge Borough Water [1]	Municipal	Surface	1,403	1,304,411	1,987,000	8.89	5.87
4	Blawnox Municipal Waterworks [4]	Municipal	Purchased	726	124,458	N.A.	N.P.	5.43
5	Braddock Borough Water Authority [1]	Authority	Purchased	711	282,246	595,408	14.23	5.78
6	Cheswick Borough Water Department [4]	Municipal	Ground	911	189,247	N.A.	N.P.	5.75
7	Coraopolis Water & Sewer Authority [1]	Municipal	Ground	2,658	553,990	642,035	8.82	5.29
8	Creswell Heights Joint Authority [1]	Authority	Ground	5,659	906,077	1,222,000	12.99	5.10
9	City of Duquesne [1]	Municipal	Purchased	2,050	550,822	992,000	N.P.	6.75
10	East Deer Township Waterworks [2]	Municipal	Purchased	624	260,202	402,742	N.P.	6.00
11	Edgeworth Borough Municipal Authority [1]	Authority	Purchased	2,311	645,506	1,100,100	N.P.	7.68
12	Etna Borough [1]	Municipal	Purchased	1,664	105,204	2,630,000	N.P.	5.75
13	Fawn Frazier Joint Water Authority [1]	Authority	Purchased	1,874	432,715	N.A.	N.P.	5.42
14	Findlay Township Water Authority [1]	Authority	Purchased	1,889	493,849	1,093,000	N.P.	7.39
15	Fox Chapel Authority [1]	Authority	Purchased	5,390	1,848,219	2,720,000	7.41	6.22
16	Glenfield Water Company [2]	Municipal	Purchased	84	18,472	N.A.	N.P.	N.P.
17	Hampton Township Municipal Authority [1]	Authority	Purchased	9,790	1,848,101	2,503,000	5.51	4.24
18	Harmar Township Municipal Authority [3]	Authority	Ground	1,100	512,460	793,000	12.00	6.42
19	Harrison Township Water Authority [1]	Authority	Surface	4,859	1,416,430	1,866,000	N.P.	6.26
20	Monroeville Municipal Authority [1]	Authority	Purchased	10,713	2,994,409	6,029,000	N.P.	5.00
21	Moon Township Water Authority [1]	Authority	Surface	7,957	2,514,283	4,099,000	N.P.	3.50
22	Neville Township [2]	Municipal	Purchased	654	551,586	N.A.	N.P.	6.00
23	Oakdale Borough [2]	Municipal	Purchased	684	134,706	N.A.	N.P.	6.20
24	Oakmont Borough Municipal Authority [1]	Authority	Surface	16,584	4,676,345	6,379,000	N.P.	3.73
25	Pennsylvania American Water Company [1]	Investor PUC	Surface	207,087	76,240,214	91,150,000	13.00	7.89
26	Pittsburgh Water and Sewer Authority [1]	Authority	Surface	80,435	70,493,158	91,048,000	15.80	5.39
27	Plum Borough Municipal Authority [1]	Authority	Purchased	10,028	2,124,251	2,756,720	12.83	3.06
28	Richland Township Municipal Authority [1]	Authority	Purchased	3,466	807,561	1,105,000	9.00	5.30
29	Reserve Township [1]	Municipal	Purchased	1,495	257,701	315,142	8.07	5.50
30	Robinson Township Municipal Authority [1]	Authority	Surface	4,619	2,789,050	4,059,360	N.P.	4.95
31	Sewickley Borough Water Authority [2]	Authority	Ground	2,211	990,569	2,208,160	12.07	8.75
32	Shaler Township Water Department [1]	Municipal	Ground	12,663	4,568,957	6,078,000	7.50	3.77
33	Borough of Sharpsburg [1]	Municipal	Ground	1,454	464,085	636,000	6.67	5.00
34	Springdale Township [3]	Municipal	Purchased	819	118,697	N.A	7.50	3.50
35	Springdale Borough Water Department [4]	Municipal	Ground	1,737	505,773	1,059,000	N.P.	6.00
36	Tarentum Borough [1]	Municipal	Surface	2,056	893,197	1,178,000	8.25	5.30
37	Western Allegheny County Municipal Authority [1]	Authority	Purchased	6,263	389,356,510	1,736,665	15.59	5.55
38	Westmoreland County Municipal Authority [1]	Authority	Surface	119,959	46,611,196	53,965,000	11.51	4.79
39	West View Borough Municipal Authority [1]	Authority	Surface	52,721	25,334,107	31,728,000	5.00	3.36
40	Wilkinsburg-Penn Joint Water Authority [1]	Authority	Surface	40,634	21,020,603	25,642,000	N.P.	4.82

(1) 2009 Public Water Supply Report
(2) 2008 Public Water Supply Report
(3) 2006 Public Water Supply Report
(4) 2005 Public Water Supply Report

N.P. = Not Provided

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- Fawn Frazier Joint Water Authority
- Findlay Township Water Authority
- Harrison Township Water Authority
- Monroeville Municipal Authority
- Moon Township Water Authority
- Oakdale Borough
- Plum Borough Municipal Authority
- Richland Township Municipal Authority
- Springdale Township
- Tarentum Borough
- Western Allegheny County Municipal Authority
- Westmoreland County Municipal Authority

Of the remaining 24 public water suppliers, the following 7 are located in the Ohio River valley at a considerable distance from the PWSA system:

- Aleppo Township Authority
- Coraopolis Water & Sewer Authority
- Edgeworth Borough Municipal Authority
- Glenfield Water Company
- Neville Township
- Robinson Township Municipal Authority
- Sewickley Borough Water Authority

A further impediment to extending service to suppliers in the Ohio River valley is that any pipeline extension would have to pass through the existing West View Borough Municipal Authority service area. The West View Authority serves customers in 24 municipalities located north and west of the PWSA system.

Of the remaining 17 Allegheny County public water suppliers, the following 4 are located in the Allegheny River valley and are also situated a considerable distance from the PWSA system:

- Cheswick Borough Water Department
- Harmar Township Municipal Authority
- Oakmont Borough Municipal Authority
- Springdale Borough Water Department

In the Monongahela River valley, two small water suppliers with limited customer bases are located within a few miles of the PWSA system. The City of Duquesne serves 2,050 customers and the Braddock Borough Water Authority serves 711 customers. However, water lines to extend service to these areas would have to be constructed through existing service areas for the Wilkinsburg-Penn Joint Water Authority and/or the Pennsylvania American Water Company.

Based on the analysis presented above, PWSA could potentially provide water to the following 11 water suppliers:

- Aspinwall Borough Water Department
- Blawnox Municipal Waterworks
- Etna Borough
- Fox Chapel Authority
- Hampton Township Municipal Authority
- Reserve Township
- Shaler Township Water Department
- Borough of Sharpsburg
- Pennsylvania American Water Company
- West View Borough Municipal Authority
- Wilkinsburg-Penn Joint Water Authority

PWSA has system interconnects with all of the above suppliers except for the Wilkinsburg-Penn Joint Water Authority. An interconnect with Etna Borough has been closed. Table 2-3 lists information regarding water supplied by PWSA via system interconnects from 2006 to 2008 based on information contained in Annual Water Supply Reports.

PWSA currently provides water for resale to Aspinwall, Fox Chapel, and Reserve Township. PWSA also acquired the Millvale water system in 2009 and now provides full managed water service to the residents of Millvale Borough. Fox Chapel provides water for resale to Blawnox.

In March 2011, municipal officials in Hampton and Shaler Townships gave approval to merge water systems and form a new Hampton-Shaler water authority. The new authority will take over operations on January 1, 2012. As a result, the probability of future water sales to Hampton and Shaler is extremely low.

Table 2-3

Water Provided by PWSA to Neighboring Systems Through Interconnects

Water Supplier	2006			2007			2008		
	Total Usage (gallons)	Number of Days	Average Usage (gpd)	Total Usage (gallons)	Number of Days	Average Usage (gpd)	Total Usage (gallons)	Number of Days	Average Usage (gpd)
Aspinwall Borough	783,000	150	5,220	35,299,000	215	164,181	65,402,000	366	178,694
Etna Borough	0	0	0	0	0	0	0	0	0
Fox Chapel No. 1 *	597,943,000	303	1,973,409	746,747,000	365	2,045,882	675,322,000	366	1,845,142
Fox Chapel No. 2 *	10,450,000	181	57,735	5,450,000	215	25,349	661,000	183	3,612
Hampton	7,124,000	365	19,518	7,961,000	265	30,042	5,883,000	366	16,074
Millvale	12,556,500	365	34,401	130,550,000	265	492,642	125,870,000	366	343,907
PA American - Esplen	0	0	0	0	0	0	0	0	0
PA American - Mt. Wash.	1,105,000	213	5,188	25,000,000	306	81,699	12,800,000	215	59,535
Reserve Township	107,016,000	365	293,195	119,256,000	365	326,729	121,641,000	366	332,352
Shaler	95,000	62	1,532	25,000	30	833	185,000	62	2,984
Sharpsburg	0	0	0	84,940,000	123	690,569	80,000	62	1,290
West View No.1	0	0	0	0	0	0	0	0	0
West View No.2	0	0	0	0	0	0	0	0	0
West View No.3	30,000	31	968	0	0	0	0	0	0
Totals			2,391,166			3,857,926			2,783,590

* Blawnox is included in the Fox Chapel Usage

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The Wilkinsburg-Penn Joint Water Authority and the West View Borough Municipal Authority are large water authorities with surface water treatment plants and significant infrastructure investments. As such, these two water providers are not good candidates for regionalization.

Excluding the suppliers discussed above, potential expansion of the PWSA water system through acquisition or water sales is limited to the following:

- Etna Borough
- Borough of Sharpsburg
- Pennsylvania American Water Company

The Shaler Township Water Department currently provides all the water used in Etna Borough. PWSA had an emergency interconnect with the Etna water system at one time but the interconnect has been closed. The Borough of Sharpsburg has its own treatment plant and water system. However, PWSA has supplied significant amounts of water to Sharpsburg during six years in the 1996 to 2008 time period. The amount of water supplied to Sharpsburg in these years ranged from 47 to 99 million gallons and averaged 73 million gallons per year.

PWSA is most interested in extending service to the portion of the City (South Hills) that is currently served by Pennsylvania American Water Company. PWSA bills all City customers for water and sewer services based on PWSA rates. However, Pennsylvania American water rates are higher than those charged by PWSA. In order to maintain uniform rates for all City residents, PWSA must subsidize the costs for customers that reside in areas served by Pennsylvania American Water. This requires PWSA to make periodic payments to Pennsylvania American to make up the difference. PWSA has paid an average of $1.43 million in subsidy to Pennsylvania American Water Company over the past 5 years.

The PWSA water system could potentially be expanded through acquisition or water sales to three adjacent water supply systems. Table 2-4 lists the suppliers along with their average day and maximum day water demands. Water demands for City of Pittsburgh residents served by Pennsylvania American Water Company were estimated based on PWSA billing records. The water suppliers listed in Table 2-4 serve almost 28,000 customers. The service areas have a combined average day demand of approximately 4.50 mgd and a maximum day demand of 7.20 mgd.

Concept Level Cost Estimates for Extending Water Service

Available information indicates that service to Etna and Sharpsburg could be provided through existing PWSA interconnects. A conceptual level estimate was developed for the cost of extending service to the portion of the City that is currently served by Pennsylvania American Water Company.

Table 2-4

Potential PWSA Water Service Expansion Areas

Supplier	Number of Customers	Average Day Demand	Maximum Day Demand	Base Rate ($/Month)	Water Cost ($/1,000 gal.)
Etna Borough	1,664	105,204	263,000	N.P	5.75
Pennsylvania American Water Company (1)	20,304	4,106,861	6,570,978	13.00	7.89
Borough of Sharpsburg	1,454	464,085	636,000	6.67	5.00
Totals	23,422	4,676,150	7,469,978		

(1) PA American Water Rate is Shown. City of Pittsburgh Residents Pay PWSA Rate

N.P. = Not Provided

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Chester Engineers previously estimated the amount of water that would be needed to serve the South Hills area in May 2008. After review of metered water use that was completed as part of the 40-Year Plan, it was determined that the original analysis overestimated the demand. An updated conceptual analysis of the cost of providing water service to City of Pittsburgh customers that are currently served by Pennsylvania American Water Company is included as Appendix 2-2. The total estimated project cost to provide service to this area is $68.60 million.

Potential for Purchasing Systems from Existing Bulk Water Customers

This section examines the potential cost-benefit to PWSA of purchasing water systems from existing bulk water customers Aspinwall, Fox Chapel and Reserve. Customer and average day demand information from Table 2-2 was used to estimate the revenues that PWSA currently receives from bulk water sales based on 2012 rates. Bulk sales revenues were then compared to the estimated revenue that would be generated if the individual customers in these communities were paying 2012 PWSA water rates. The results of these analyses are summarized in Table 2-5.

Table 2-5 indicates that estimated revenues to PWSA from Aspinwall and Reserve would more than double relative to bulk sales revenues if the residents in these communities were PWSA customers. Estimated revenues would almost quadruple from Fox Chapel if the residents were PWSA customers. In total, water revenues from these communities would be an estimated $4.1 million per year higher if the residents were PWSA customers rather than the communities being bulk rate customers.

In order for the purchase of a water system to make economic sense, the increase in water revenues has to exceed the sum of the annualized purchase price for the system plus any annual capital, operation and maintenance costs associated with ownership of the system. As noted earlier in this section, PWSA acquired the Millvale water system and now provides full managed water service to the residents of Millvale Borough. Prior to 2009, Millvale was a bulk water customer. The cost history for the Millvale water system can be used to estimate capital, operation, and maintenance costs for other systems and allow development of prices for potential water system purchases. If the initial economic evaluation is positive, discussions can be initiated with the system owner regarding system acquisition by PWSA.

2.4 EVALUATE SEWER SYSTEM EXPANSION OPTIONS

Wastewater from 23 neighboring communities flows into and through the PWSA sewer system to ALCOSAN. Figure 2-2 identifies the tributary municipalities and highlights the portion of each borough or township that contributes flow to the PWSA.

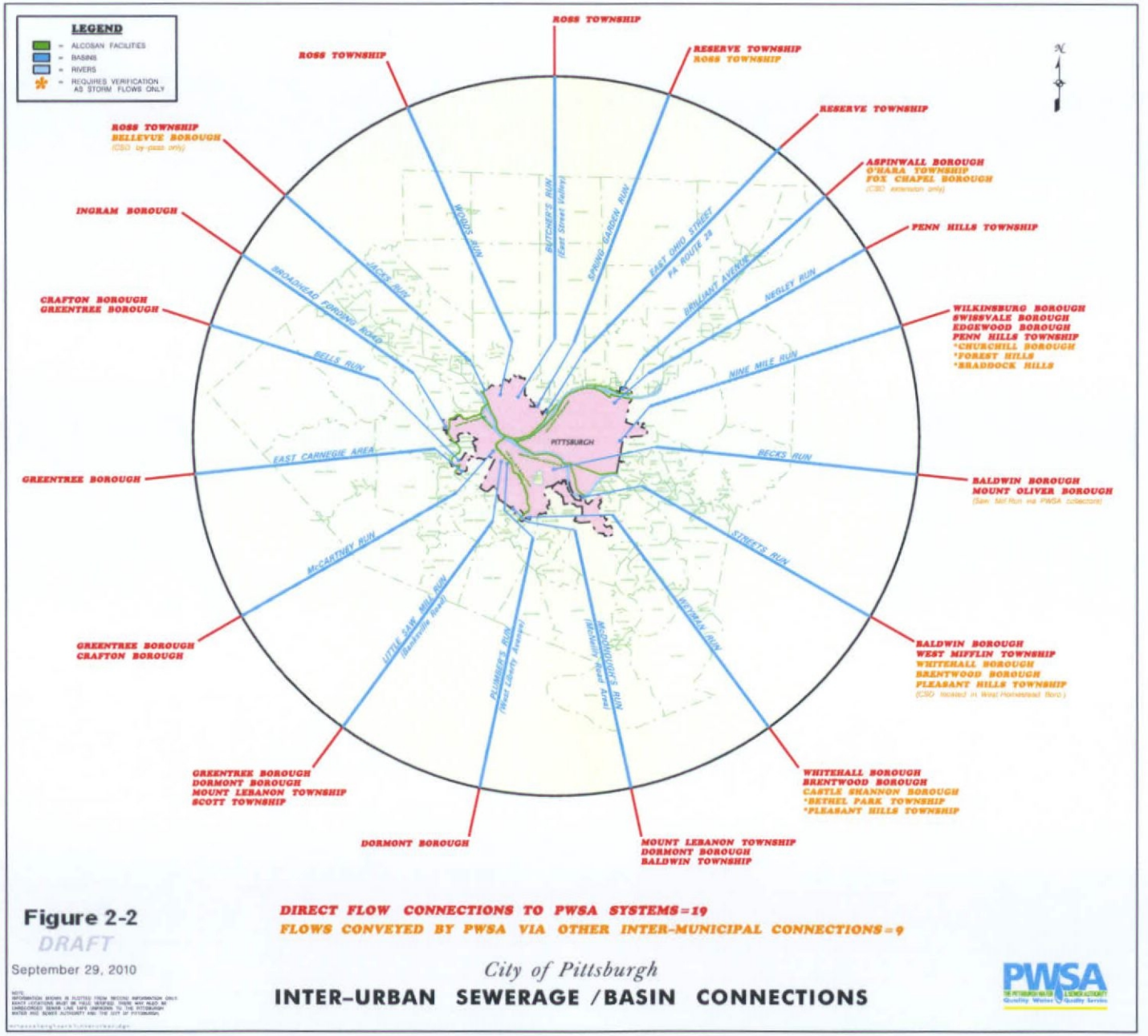

Figure 2-2

DRAFT

September 29, 2010

DIRECT FLOW CONNECTIONS TO PWSA SYSTEMS = 19

FLOWS CONVEYED BY PWSA VIA OTHER INTER-MUNICIPAL CONNECTIONS = 9

City of Pittsburgh

INTER-URBAN SEWERAGE / BASIN CONNECTIONS

PWSA

Table 2-5

Estimated Revenues From Bulk Water Rates Versus PWSA Rates

Bulk Water Customer	Number of Customers	Average Month Demand (gpd)	2012 Estimated Annual Bulk Revenue	2012 Estimated Revenue as PWSA Customers	Estimated Revenue Difference
Borough of Aspinwall	1,201	7,061,655	$267,778	$637,151	$369,373
Fox Chapel Water Authority	5,390	56,216,661	1,191,308	4,525,188	3,333,880
Reserve Water Department	1,495	7,838,405	318,633	728,469	409,836
Totals	8,086	71,116,722	$1,777,719	$5,890,807	$4,113,088

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OSBA-I-4 Attach A

Tributary Sewer System Information

Table 2-6 presents information about neighboring sewer systems that are tributary to PWSA. One sewer system is owned by a sewer authority but the remaining systems are municipally owned. The number of customers in each system was estimated through a GIS analysis of the number of buildings in each sewershed area. The general condition of each system and significant Consent Order and Agreement (COA) issues were determined based on review and assessment of the information contained in system inventory and characterization reports (Existing Conditions Reports) developed by ALCOSAN. Base rate information was obtained from an October 2010 sewer rate survey conducted by the 3 Rivers Wet Weather Demonstration Project. The 23 tributary systems contain an estimated 42,405 customers that contribute flow to PWSA.

Existing Rate Information

Table 2-6 also presents base rate information for each sewer system. Base rates range from a low of $0.63 per 1,000 gallons in Bellevue to a high of $7.85 per 1,000 gallons in Mt. Oliver. The base rate represents the sewer charge imposed by the municipality and does not include ALCOSAN charges.

Potentially Feasible Candidates for Regionalization

General conditions of sewer systems and the existence of significant COA issues were used to evaluate systems relative to their need for capital improvement projects to address system deficiencies. Table 2-7 presents a ranking of the tributary sewer systems. Systems at the top of the list, which are in good condition and have no COA issues, are anticipated to have the lowest capital improvement costs. Systems with combined sewers are ranked lower because they are expected to encounter higher costs of achieving COA compliance. Systems for which the general system condition is unknown were placed at the bottom of the list. Although this is a somewhat subjective evaluation, systems at the top of the list are considered to be better candidates for regionalization than systems lower on the list.

Because of the unknown costs of upgrading sewer systems to meet COA requirements, assuming ownership of a sewer system by itself would have to be considered a liability. Nevertheless, it could be advantageous for PWSA to take over a sewer system if the service agreement also included providing water to a new community. Owners of three sewer systems listed in Table 2-6 also own the public water systems in their communities. However, PWSA already sells bulk water to Fox Chapel Borough, Aspinwall Borough, and Reserve Township. As a result, there appears to be little incentive for PWSA to take over the sewer systems in these communities.

Table 2-6

Tributary Sewer System Information

	System	Ownership	Dual Water and Sewer Ownership	Number of Customers (1)	General Condition of System (2)	Significant COA Issues (2)	Base Rate (3) ($/1,000 gal)
1	Aspinwall Borough	Municipal	X	355	Fair to Good	88% Combined	$1.73
2	Baldwin Borough	Municipal		5,279	Unknown	None	4.21
3	Baldwin Township	Municipal		638	Good	Portions Combined	4.50
4	Bellevue Borough	Municipal		413	Good	Portions Combined	0.63
5	Braddock Hills	Municipal		41	Unknown	None	1.50
6	Brentwood Borough	Municipal		4,235	Good	None	4.40
7	Castle Shannon	Municipal		61	Fair	None	4.80
8	Churchill Borough	Municipal		277	Good	None	2.50
9	Crafton Borough	Municipal		421	Fair	CSO Permittee	6.50
10	Dormont Borough	Municipal		3,476	Fair	None	3.50
11	Edgewood Borough	Municipal		1,330	Unknown	None	3.70
12	Forest Hills	Municipal		15	Fair	None	3.00
13	Fox Chapel Borough	Municipal	X	253	Good	None	1.65
14	Green Tree Borough	Municipal		2,087	Good	None	3.00
15	Ingram Borough	Municipal		100	Good	Combined Sewers	3.75
16	Mount Lebanon	Municipal		1,371	Fair	None	4.05
17	Mount Oliver	Municipal		1,553	Unknown	None	7.85
18	Penn Hills, Municipality of	Municipal		910	Good	None	6.95
19	Pleasant Hills Borough	Municipal		32	Good	None	2.16
20	Reserve Township	Municipal	X	1,178	Unknown	Unknown	1.17
21	Ross Township	Municipal		1,440	Unknown	Unknown	2.25
22	Scott Township	Municipal		780	Fair	None	1.50
23	Swissvale Borough	Municipal		1,858	Fair to Good	Combined Sewers	1.50
24	West Mifflin Borough	Authority		581	Fair	None	4.82
25	Whitehall Borough	Municipal		4,996	Unknown	None	5.53
26	Wilkinsburg Borough	Municipal		7,032	Fair to Good	Illegal Storm Connections	1.19

(1) Customer Information From Figure 2-2
(2) General System Condition and Significant COA Issues Were Determined From Review of Individual Basin Reports for the ALCOSAN Service Area
(3) Base Rate Information is From an October 2010 Sewer Rate Survey by The 3 Rivers Wet Weather Demonstation Project

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OSBA-I-4 Attach A

Table 2-7

Sewer System Rankings

	System	Ownership	Dual Water and Sewer Ownership	Number of Customers (1)	General Condition of System (2)	Significant COA Issues (2)	Base Rate (3) ($/1,000 gal)
1	Fox Chapel Borough	Municipal	X	253	Good	None	$1.65
2	Pleasant Hills Borough	Municipal		32	Good	None	2.16
3	Churchill Borough	Municipal		277	Good	None	2.50
4	Green Tree Borough	Municipal		2,609	Good	None	3.00
5	Brentwood Borough	Municipal		4,235	Good	None	4.40
6	Penn Hills, Municipality of	Municipal		873	Good	None	6.95
7	West Mifflin Borough	Authority		581	Fair	None	4.82
8	Scott Township	Municipal		780	Fair	None	1.50
9	Dormont Borough	Municipal		3,476	Fair	None	3.50
10	Mount Lebanon	Municipal		2,750	Fair	None	4.05
11	Wilkinsburg Borough	Municipal		7,029	Fair to Good	Illegal Storm Connections	1.19
12	Bellevue Borough	Municipal		413	Good	Portions Combined	0.63
13	Baldwin Township	Municipal		638	Good	Portions Combined	4.50
14	Aspinwall Borough	Municipal	X	355	Fair to Good	88% Combined	1.73
15	Ingram Borough	Municipal		100	Good	Combined Sewers	3.75
16	Swissvale Borough	Municipal		1,830	Fair to Good	Combined Sewers	1.50
17	Crafton Borough	Municipal		421	Fair	CSO Permittee	6.50
18	Edgewood Borough	Municipal		1,330	Unknown	None	3.70
19	Baldwin Borough	Municipal		5,279	Unknown	None	4.21
20	Whitehall Borough	Municipal		4,973	Unknown	None	5.53
21	Mount Oliver	Municipal		1,553	Unknown	None	7.85
22	Reserve Township	Municipal	X	1,178	Unknown	Unknown	1.17
23	Ross Township	Municipal		1,440	Unknown	Unknown	2.25

(1) Customer Information From Figure 2-2
(2) General System Condition and Significant COA Issues Were Determined From Review of Individual Basin Reports for the ALCOSAN Service Area
(3) Base Rate Information is From an October 2010 Sewer Rate Survey by The 3 Rivers Wet Weather Demonstation Project

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Excluding concerns regarding unknown costs for COA compliance, the best candidates for regionalization would be sewer systems in good condition that have significant customer populations and no significant COA issues. The sewer systems in Green Tree Borough and Brentwood Borough meet these criteria.

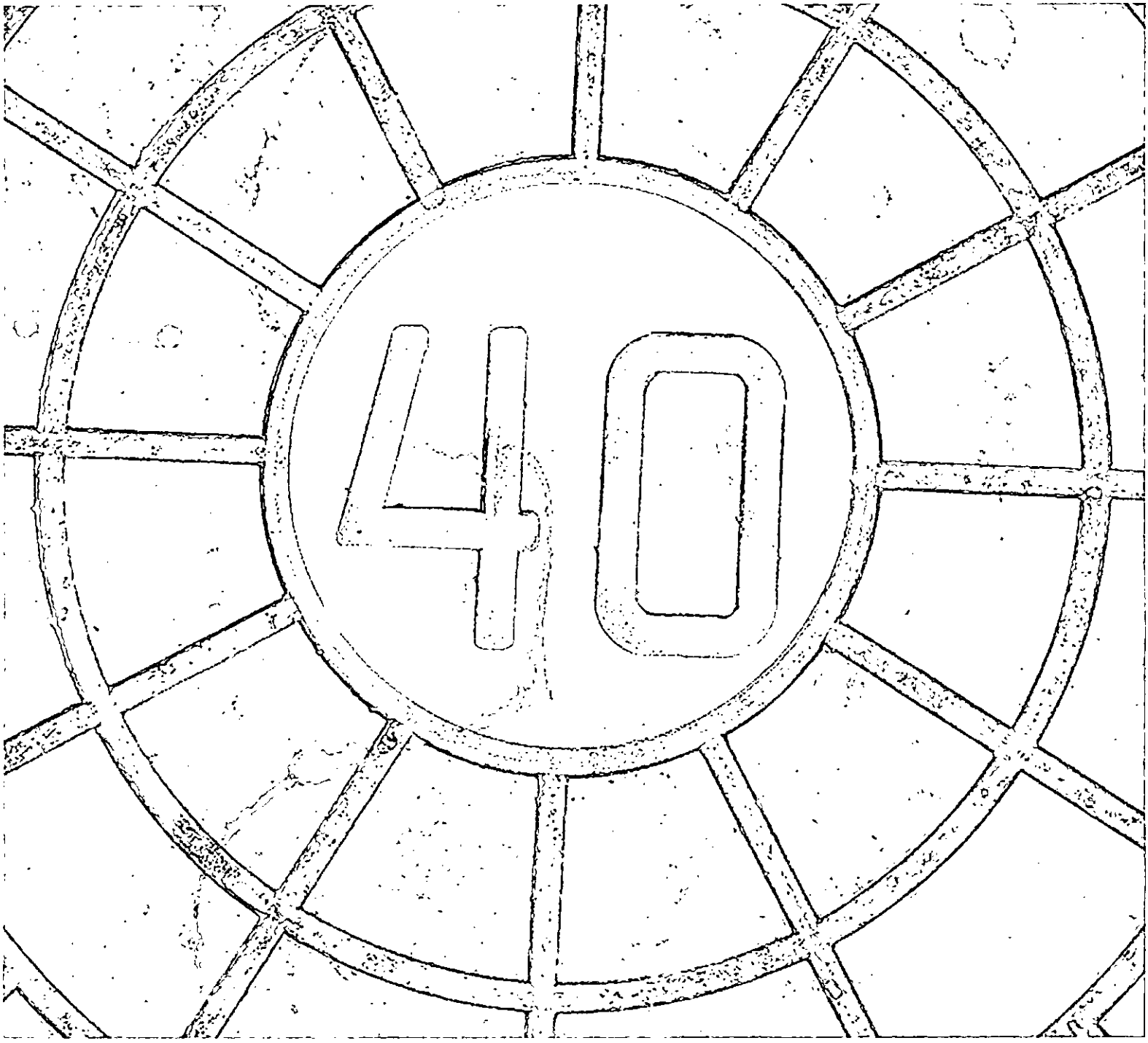
2.5 ASSESS POTENTIONAL ACQUISITIONS

Based on the information collected under Task 2, the potential for acquisition of individual water or sewer systems is limited to systems in communities that are adjacent to the PWSA service area. At the meetings conducted under Task 2.1, DEP representatives noted that water system regionalization opportunities exist with surrounding communities including Reserve, Aspinwall, Fox Chapel, Blawnox, and Millvale. However, PWSA already provides water for resale to the first three communities and has provided full managed water services to Millvale since 2009. Fox Chapel provides water for resale to Blawnox.

The analysis of Allegheny County public water providers under Task 2.3 concluded that potential expansion of the PWSA water system through acquisition or water sales is limited to Etna Borough, Sharpsburg Borough, and the portion of the City that is currently served by Pennsylvania American Water Company. Etna and Sharpsburg could be served via existing PWSA interconnects but significant capital expenditures would be required to serve the South Hills portion of the City of Pittsburgh.

Sewer system expansion options were evaluated under Task 2.4. There are 23 neighboring communities with wastewater flows that pass through the PWSA system on their way to ALCOSAN for treatment. Unfortunately, insufficient information is available to estimate costs for COA compliance in neighboring municipalities. Excluding the unknown costs for COA compliance, the best candidates for regionalization would be sewer systems in good condition that have significant customer populations and no significant COA issues. The sewer systems in Green Tree Borough and Brentwood Borough meet these general criteria.

TASK 3



THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR PLAN
TASK 3 - COMPLETE AN ASSESSMENT OF NEEDS

3.1 SYSTEM INVENTORY AND SYSTEM VALUATIONS

An inventory of the PWSA water and sewer systems was developed by examining available information to identify the various components that make up the systems. Information of interest for water and sewer lines (pipe lengths and diameters, numbers of valves and hydrants, numbers of manholes and structures, materials of construction) was determined from information contained in the PWSA GIS. Site visits to pump stations, water storage tanks, and treatment facilities were also conducted to assess the general condition of above-ground facilities. System valuations were then completed for the water and sewer systems based on the age and condition of the facilities.

System Inventory

Separate inventories were prepared in Excel spreadsheet format for all identified water and sewer system components. The collected information summarizes the age, type, and general condition of PWSA facilities. Detailed information regarding the process equipment, pumps, and other items housed in buildings were cataloged separately as part of Task 3.7.

Table 3-1 presents an inventory of PWSA water treatment, pumping, and storage facilities. Information is also provided for chlorine booster stations at water storage facilities. Table 3-1 provides a name, location, and description for all above-ground water facilities and lists the year in which a facility was constructed and/or last rehabilitated.

Treatment facilities include the 117 mgd capacity water filtration plant at Aspinwall and the 26 mgd capacity membrane filtration plant at the Highland No. 1 reservoir. There are 12 water pumping stations in the PWSA system. This total does not include the Ross pump station, which supplies raw water to the Aspinwall treatment plant. The Millvale pump station was constructed before PWSA took over the Millvale water system but was never placed into service.

Water storage facilities include 4 in-ground reservoirs and 12 above-ground storage tanks. Above-ground storage facilities include 10 ground level tanks or standpipes and two elevated tanks. Three of the four reservoirs have floating covers. Highland No. 1

Table 3-1

Water Treatment, Pumping, Storage, and Chlorine Booster Facilities

Type of Facility	Facility Name	Location	Description	Year Constructed	Last Rehabilitation	
					Structural	Mechanical
Rapid Sand Filtration Plant	Raw Water Intakes	Aspinwall	2 Intakes With Auto Backwash Moving Screens, Permitted for 100 mgd	1908		
	Ross Pump Station	Aspinwall	Raw Water PS, 5 Pumps, 400 mgd max , to Clarifiers or Sed. Basins	1907		
	Clarifiers	Aspinwall	4 units, 220' x 60' x 20' deep	1962		
	Sedimentation Basins	Aspinwall	2 Basins, 15 Hour Detention Time @ Design Flow	1908		
	Rapid Sand Filters	Aspinwall	18 Filters, 2,280 sq. ft. each, sand and anthrafilt	1969		
	Clearwell	Aspinwall	22.5 feet deep, 44.5 MG, supplies 3 high lift pump stations	1908		
	Access Tunnel at Treatment Plant	Aspinwall	Asphalt road surface, concrete walls, 350 feet long by 12 feet wide	1908	1908	1908
Membrane Filtration Plant	Highland Membrane Filtration Plant	Highland Park	13,889 gpm or 20 mgd capacity / 18,056 gpm or 26 mgd capacity	2002		
Pumping	Aspinwall Pump Station	Aspinwall	4 Pumps, 34 mgd max., pump to Lanpher Reservoir	1914		
	Bruecken Pump Station	Highland Park	3 Pumps (2-4), 84 mgd max., pump to Highland #13 Pumps (5-7), 72 mgd max., pump to Highland #2	1931		
	Fox Chapel Pump Station		4 Pumps, 6 mgd max., pump to Fox Chapel Borough	2003		
	Herron Hill Pump Station	Herron Hill	4 Pumps (1-4), 23 mgd max., pump to Herron Hill 1 Pump (5), 10.0 mgd, pump to Herron Hill or Squirrel Hill 1 Pump (6), 2 mgd max., pump to Bedford	1931		
	Herron Hill Tank Pump Station	Herron Hill	2 Pumps, 3.4 mgd max, pump to Herron Hill tank	1963		
	Highland Pump Station	Highland Park	3 Pumps, 7.8 mgd max., pump to Garfield Tank	1960		
	Howard Pump Station	North Side	4 Pumps (1-4), 22 mgd max., pump to Spring Hill/McNaugher 3 Pumps (5-7), 9.5 mgd max., pump to Brashear	1904		
	Inline Pump Station at Pacific & Coral	Friendship District	1 Pump, 0.14 mgd, 1 Pump, 0.29 mgd, pump to Distribution in Friendship	1981		
	Lincoln Pump Station	Lincoln-Lemington	3 Pumps, 6 mgd max. (combined capacity), pumps to Lincoln	1952		
	Millvale Pump Station	Millvale	2 pumps, 1.4 mgd, pumps to Millvale Tank	1996		
	Mission Pump Station	South Side	3 Pumps (1-3), 18 mgd max., + 1 Pump (4), 12 mgd + 1 Pump (5), 8 mgd, pump to Allentown	1912		
	Saline Pump Station	Greenfield	3 Pumps, 9 mgd max.(combined capacity), pump to Squirrel Hill	1935		
Storage	Herron Hill Reservoir	Herron Hill	12.8 MG capacity in-ground reservoir, floating cover	1880		
	Highland No. 1 Reservoir	Highland Park	130.5 MG capacity in-ground reservoir, UNCOVERED	1879		
	Highland No. 2 Reservoir	Highland Park	125 MG capacity in-ground reservoir, floating cover	1903		
	Lanpher Reservoir	Shaler Township	133 MG capacity in-ground reservoir, floating cover	1914		
	McNaugher Reservoir	North Side	2 Concrete Tanks, 5 MG (185' dia. x 25' h) and 0.40 MG (50' dia. X 25' h)	1998		
	Allentown Tanks	Allentown	2 riveted steel tanks, 2.88 MG each (100' dia x 51' h)	1939		
	Bedford Tank	Hill District	1 welded steel tank, 2.1 MG capacity	1993		
	Brashear Tanks	North Side	2 welded steel tanks, 5.5 MG capacity each	2010		
	Herron Hill Tank	Herron Hill	1 elevated welded steel tank, 0.40 MG capacity	1967		
	Garfield Tank	Garfield	1 elevated welded steel tank, 1.9 MG capacity	1959		
	Lincoln Tank	Lincoln-Lemington	1 welded steel tank, 3 MG capacity (93' dia x 62' h)	1939		
	Spring Hill Tanks	Spring Hill	2 riveted steel tanks, 0.47 MG capacity each (50' dia x 34' h)	1928		
	Squirrel Hill Tank	Squirrel Hill	1 welded steel tank, 3.0 MG capacity (80' dia x 82' h)	1939		
Chlorine Booster Stations	Chlorine Booster Station	Brashear Tank	2 - 100 gal Tanks, 2 Feed Pumps - 0.37 GPH	1952		
	Chlorine Booster Station	Bedford Tank	2 - 100 gal Tanks, 2 Feed Pumps - 0.37 GPH	2004		
	Chlorine Booster Station	Garfield Tank	Taken out of Service	2004		
	Chlorine Booster Station	Herron Hill Reservoir	3 - 100 gal Tanks, 3 Feed Pumps - 0.55 GPH	1952		
	Chlorine Booster Station	Highland No. 2	6 - 160 gal Tanks, 2 Feed Pumps - 13.0 GPH	1952		
	Chlorine Booster Station	Lanpher Reservoir	5 - 160 gal Tanks, 2 Feed Pumps - 13.0 GPH	1952		
	Chlorine Booster Station	McNaugher Res.	2 - 100 gal Tanks, 2 Feed Pumps - 0.37 GPH	1952		
	Chlorine Booster Station	Allentown Tanks	2 - 100 gal Tanks, 3 Feed Pumps - GPH	2009		
	Chlorine Booster Station	Lincoln Tank	2 - 100 gal Tanks, 2 Feed Pumps - GPH	2009		
	Chlorine Booster Station	Squirrel Hill Tank	2 - 100 gal Tanks, 2 Feed Pumps - GPH	2009		

reservoir is not covered, so all the water that passes through this reservoir must be re-treated by the membrane filtration plant before it is distributed to customers. PWSA currently has 9 chlorine booster stations. The chlorine booster station at the Garfield tank has been taken out of service.

Table 3-2 presents information about the four PWSA sewage pumping stations including name, location, description, and the approximate year when the stations were last rehabilitated. The Rogers Street pump station has 1,000 gpm capacity pumps and is the largest sewage pumping facility. The Evergreen Road facility is the smallest of the four stations and has a capacity of 150 gpm.

Water distribution system and sewer system data was taken from the PWSA GIS. Summary statistics for the PWSA water distribution system are listed below:

- 5,341,000 linear feet or 1,012 miles of waterlines, 1-inch to 120-inch diameter.
- 25,330 valves.
- 7,558 hydrants.
- 2/3 of pipelines in system are 6 and 8-inches in diameter.
- 3/4 of pipelines in system are 6, 8, and 12-inches in diameter.
- Oldest pipes and valves date back to 1887.

Statistics for the PWSA sewer system are summarized below:

- 6,395,000 linear feet or 1,211 miles of sewers, 3-inch to 168-inch diameter.
- 29,084 manholes.
- 24,143 catch basins/inlets.
- 99 diversion structures.
- Oldest sewers date back to 1900.

Detailed inventory information for the water distribution and sewer systems can be found in Appendices 3-1 and 3-2.

System Valuations

A Replacement Cost New Less Depreciation analysis was conducted to determine system valuations. This type of analysis estimates how much it would cost to construct new facilities today and then adjusts replacement costs for individual facilities to account for their age via straight line depreciation. System valuations for the water and sewer systems were developed based upon established service lives for different types of facilities and estimated remaining service lives for individual components based on age.

Table 3-2

Sewage Pumping Stations

Facility Name	Location	Description	Year Last Rehabilitated
Evergreen Road Pump Station	Summer Hill	2 pumps, 150 gpm capacity, 15 HP	1983
Mifflin Road Pump Station	Lincoln Place	2 pumps, 500 gpm capacity, 20 HP	2008
Rogers Street Pump Station	Lincoln Place	2 pumps, 1,000 gpm capacity, 40 HP	2008
Browns Hill Road Pump Station	Hazelwood	2 pumps, 250 gpm capacity, 10 HP	1983

Cost Estimating Approach

The first step in the process was to estimate how much it would cost to construct new water and sewer facilities today. Costs estimates for new water distribution and sewer system components were based on information from the publication *RS Means Heavy Construction Cost Data 2011*. This information was supplemented with actual bid prices from recent PWSA contracts. Costs for new water storage tanks were also determined using information from RS Means. Foundation costs were added to the tank costs to arrive at an estimated cost for each storage facility.

A replacement cost for the Lanpher reservoir was estimated by trending the original reservoir cost to April 2011 price levels using the Engineering New-Record Construction Cost Index (ENRCCI). The article in Appendix 3-3 describes design and construction of the Lanpher Reservoir. The project was awarded in July 1912 at a cost of $681,976. Costs for the other in-ground reservoirs and the sedimentation basins at the Aspinwall plant were estimated based on the calculated unit cost for the Lanpher facility and the storage volume for the basin. Costs for floating covers on the Lanpher, Herron Hill and Highland No. 1 reservoirs were estimated based on unit prices for the Highland No. 2 Floating Cover Replacement Project.

Costs for new booster pump stations were estimated using information from the March 2011 low bid price received for a booster pump station that Chester Engineers designed for a western Pennsylvania client. A unit cost per square foot was developed to cover building costs. The cost for new pumps was added to the building cost along with an allowance for piping, valves, and accessories. These components typically account for about 80 percent of the cost for pumping facilities. Electrical work makes up another 12 percent of the total, while general requirements and site work round out the total.

Replacement costs for treatment facilities were estimated as follows:

- Cost for Highland membrane filtration plant was based on the original and expansion costs for the facility trended to April 2011 price levels using the ENRCCI.
- Cost for the raw water intakes were estimated based on the cost for the traveling screens and size of the intake facilities.
- Cost for the Ross Pump Station was estimated using the procedure described above for the other pump stations.
- Cost for the clarifiers, filters, and chemical feed systems was based on the trended construction cost for a 30 mgd water treatment plant expansion project in Nashville, Tennessee that was designed by Chester Engineers in the 1990's.

The estimated cost for the clearwell was based on a trended cost for clearwell rehabilitation from a December 2008 report by Malcolm Pirnie, Inc. titled "Clearwell Improvements Phase 1 – Study". This report contained an estimated construction cost of $52,817,000 for the clear water basin at the Aspinwall plant. The clearwell cost was trended from December 2008 to April 2011 price levels using the ENRCCI.

Table 3-3 presents estimated replacement costs for existing waterlines in the PWSA system. Unit installation costs for pipeline include excavation, backfill, paving, pipe, and a 10 percent allowance for fittings. Water distribution system cost estimating information can be found in Appendix 3-4. Cost estimates are based on a 4-foot depth of cover over the installed pipe and the piping materials listed. Only about 8 percent of the waterlines in the GIS have material designations. Since almost 98 percent of these pipelines are designated as ductile iron, this material was assumed for the majority of the lines. Pipes smaller than 4-inch diameter were assumed to be copper and lines larger than 48-inches were assumed to be pre-stressed concrete cylinder pipe (PCCP). The replacement cost for the 1,011 miles of waterlines in the PWSA system is estimated to be $627.04 million.

Estimated replacement costs for the fire hydrants and valves in the water distribution system are listed in Table 3-4. The unit costs in the table are for gate valves since over 98 percent of the valves in the GIS are designated as this type of valve. Unit cost information for 4-inch to 36-inch valves is from R.S. Means Heavy Construction Cost Data 2011 and includes material, labor, equipment, overhead, and profit. Costs for larger valve sizes are estimated based on linear regression of unit costs for valves in the 24 to 36-inch range. Excavation, backfill, and paving costs are covered in the pipeline cost estimate. The replacement cost for the hydrants in the PWSA water system is estimated at $18.90 million and the valve replacement cost is estimated to be $62.47illion. The total estimated replacement cost for valves and hydrants is $84.37 million.

Table 3-5 presents estimated replacement costs for water treatment, pumping, and storage facilities in the PWSA system. The total replacement cost for these facilities is estimated to be $539.06 million. Details regarding treatment, pumping, and storage cost estimating information can be found in Appendix 3-5.

Estimated replacement costs for the sewer system are presented in Table 3-6. Sewer system components include sewers, manholes, catch basins, diversions structures, and four sewage pumping stations. Unit costs for sewers, manholes, and catch basins are from *RS Means Heavy Construction Data 2011*. Unit costs for diversion structures and sewage pump stations are trended costs from a 2005 Tapping Fee Study for PWSA. Installation costs for sewers include excavation, backfill, paving, pipe, and a 2 percent allowance for fittings. Cost estimates are based on a 10-foot depth of cover over the installed sewers. Sewer system cost estimating information can be found in Appendix 3-6. The majority of the sewer segments in the GIS have material designations. The most

Table 3-3

Estimated Replacement Cost for Existing Waterlines Based on 2011 Construction Costs *

Pipe Diameter (inches)	Pipe Material	Estimated Length (feet)	Installed Unit Cost (1)	Total Cost
1	Copper	3,542	$31	$109,802
2	Copper	18,670	50	933,500
4	Ductile Iron	175,022	63	11,026,386
6	Ductile Iron	2,469,029	78	192,584,262
8	Ductile Iron	1,099,859	94	103,386,746
10	Ductile Iron	92,308	109	10,061,572
12	Ductile Iron	566,140	125	70,767,500
15	Ductile Iron	18,166	148	2,688,568
16	Ductile Iron	253,550	156	39,553,800
18	Ductile Iron	1,058	172	181,976
20	Ductile Iron	209,148	188	39,319,824
24	Ductile Iron	85,857	219	18,802,683
30	Ductile Iron	117,803	267	31,453,401
36	Ductile Iron	82,812	315	26,085,780
42	Ductile Iron	24,481	364	8,911,084
48	Ductile Iron	16,150	413	6,669,950
50	PCCP	36,300	453	16,443,900
60	PCCP	56,167	596	33,475,532
66	PCCP	2,170	655	1,421,350
72	PCCP	3,715	719	2,671,085
84	PCCP	3,873	931	3,605,763
90	PCCP	50	1,101	55,050
96	PCCP	4,361	1,272	5,547,192
120	PCCP	524	2,453	1,285,372
Total		5,340,755		$627,042,000

* Cost Information From R.S. Means Heavy Construction Data 2011

(1) Includes Pipe Material, Excavation, Installation, Backfill, and Paving

PCCP = Prestressed Concrete Cylinder Pipe

Table 3-4

Estimated Replacement Cost for Fire Hydrants and Valves
Based on 2011 Construction Costs *

Component	Diameter (inches)	Estimated Quantity	Installed Unit Cost (1)	Total Cost
Hydrants		7,558	2,500	$18,895,000
Valves	< 4	120	400	48,000
	4	609	785	478,065
	6	14,722	1,050	15,458,100
	8	5,703	1,275	7,271,325
	10	364	1,690	615,160
	12	2,363	2,100	4,962,300
	15	38	4,040	153,520
	16	545	5,975	3,256,375
	18	4	9,190	36,760
	20	321	12,400	3,980,400
	24	189	18,400	3,477,600
	30	154	45,000	6,930,000
	36	93	67,500	6,277,500
	42	32	92,700	2,966,400
	48	51	117,300	5,982,300
	50	8	125,500	1,004,000
	60	11	166,400	1,830,400
	72	2	215,500	431,000
	96	1	313,700	313,700
Subtotal Valves				65,473,000
Total Estimated Replacement Cost for Hydrants and Valves				$84,368,000

* Unit Cost Information From R.S. Means Heavy Construction Cost Data 2011
(1) Includes Material, Labor, Equipment, Overhead and Profit

Table 3-5

Estimated Replacement Costs for Water Treatment, Pumping, and Storage Facilities

Category	Facility Name	Estimated Cost
Treatment	Raw Water Intakes	$3,500,000
	Ross Pump Station	18,853,000
	Clarifiers, Filters, and Chem. Feed	131,100,000
	Sedimentation Basins	37,255,000
	Clearwell	55,756,000
	Highland Membrane Filtration Plant	15,791,000
	Treatment Subtotal	262,255,000
Pumping	Aspinwall Pump Station (1)	14,149,000
	Bruecken Pump Station	11,726,000
	Herron Hill Pump Station	4,598,000
	Herron Hill Tank Pump Station (2)	77,000
	Highland Pump Station	1,495,000
	Howard Pump Station	8,043,000
	Inline Pump Station (3)	219,000
	Lincoln Pump Station	1,206,000
	Mission Pump Station	6,626,000
	Saline Pump Station	1,693,000
	Pumping Subtotal	49,832,000
Storage	Herron Hill Reservoir	6,233,000
	Highland No. 1 Reservoir	62,594,000
	Highland No. 2 Reservoir	65,210,000
	Lanpher Reservoir	69,147,000
	McNaugher Tank No. 1	2,280,000
	McNaugher Tank No. 2	400,000
	Allentown Tank No. 1	1,510,000
	Allentown Tank No. 2	1,510,000
	Bedford Tank	1,190,000
	Brashear Tank No. 1	2,890,000
	Brashear Tank No. 2	2,890,000
	Herron Hill Tank	1,360,000
	Garfield Tank	5,850,000
	Lincoln Tank	1,590,000
	Spring Hill Tank No. 1	390,000
	Spring Hill Tank No. 2	390,000
	Squirrel Hill Tank	1,540,000
	Storage Subtotal	226,974,000
Total Estimated Cost for Treament, Pumping, and Storage Facilities		$539,061,000

(1) Includes Fox Chapel Pumps
(2) Represents Pump Replacement Cost (Pumps Are In Base of Elevated Tank)
(3) Packaged Pump Station, Buried in Street

Table 3-6

Estimated Replacement Cost for Sewer System
Based on 2011 Construction Costs *

Description	Diameter (inches)	Pipe Material	Length (feet)	Installed Unit Cost (1)	Total Cost
Sewers	4	PVC	1,892	$63	$119,196
	6	PVC	3,035	74	224,590
	8	PVC	776,734	84	65,245,656
	10	PVC	142,493	95	13,536,835
	12	PVC	650,695	102	66,370,890
	15	PVC	2,771,834	113	313,217,242
	18	RCP	570,348	142	80,989,416
	21	RCP	274,971	157	43,170,447
	24	RCP	337,942	175	59,139,850
	27	RCP	14,213	211	2,998,943
	30	RCP	138,192	230	31,784,160
	33	RCP	24,999	249	6,224,751
	36	RCP	186,113	268	49,878,284
	39	RCP	15,688	291	4,565,208
	42	RCP	79,174	314	24,860,636
	45	RCP	6,319	338	2,135,822
	48	RCP	92,183	361	33,278,063
	54	RCP	55,723	406	22,623,538
	60	RCP	52,652	452	23,798,704
	66	RCP	38,486	522	20,089,692
	72	RCP	54,351	593	32,230,143
	78	RCP	25,654	676	17,342,104
	84	RCP	16,849	760	12,805,240
	90	RCP	11,001	839	9,229,839
	96	RCP	20,958	919	19,260,402
	102	PCCP	10,371	1,300	13,482,300
	108	PCCP	9,410	1,681	15,818,210
	120	PCCP	2,832	2,414	6,836,448
	132	PCCP	3,062	2,651	8,117,362
	144	PCCP	6,125	2,890	17,701,250
	168	PCCP	1,028	3,373	3,467,444
Subtotal Sewers			6,395,327		1,020,543,000
Description			Quantity	Unit Cost	Total Cost
Manholes (2)			29,084	5,650	164,325,000
Catch Basins (2)			24,143	2,825	68,204,000
Diversion Structures (3)			99	95,000	9,405,000
Pump Stations (3)			4	600,000	2,400,000
Subtotal Other Items					244,334,000
Total Estimated Replacement Cost for Sewer System					$1,264,877,000

* Cost Information From R.S. Means Heavy Construction Cost Data 2011
(1) Includes Material, Excavation, Installation, Backfill, and Paving
(2) Includes Material, Labor, Equipment, Overhead and Profit
(3) Trended Cost From 2005 Tapping Fee Study

common sewer materials are vitrified clay pipe (VCP), reinforced concrete pipe (RCP), brick, and polyvinyl chloride (PVC). PWSA allows PVC to be used for sewers up to 15-inches in diameter. For larger lines, VCP is used for sanitary sewers and RCP is used for storm sewers. Since brick is no longer used for sewer and manhole construction, replacement cost estimates were based on PVC for the smaller sewers and concrete pipe for the larger lines. The replacement cost for the PWSA sewer system is estimated to be $1.265 billion.

Replacement Cost New Less Depreciation Analysis

The second step in the process involves depreciating the calculated replacement cost for the water and sewer facilities to account for the ages of individual components. This analysis was complicated by the fact that limited digital information is available regarding the age of water and sewer lines. The PWSA GIS includes installation date information for the facilities listed below:

- 6.0 percent of waterlines.
- 7.1 percent of valves.
- 0.0 percent of hydrants.
- 7.4 percent of sewers.
- 9.9 percent of manholes.
- 5.2 percent of catch basins.
- 46.5 percent of diversion structures.

As part of the main break analysis, estimated ages for waterlines and valves were determined by cross referencing GIS data with information from record books and calc books. PWSA provided Chester with geodatabase information for pipes as GIS features. The database included annotations with references to the office record books and calculation books associated with individual pipe segments. The record books and calculation books provide construction drawings for specific pipe segments and the dates of these books indicate the age of the pipes. The following procedure was used to assign an installation year to pipe segments and valves that did not have an age designation:

- PWSA provided a cross reference table between the record and calculation books and the data of the books
- The cross reference table was matched to the GIS annotations.
- The average installation year from the cross reference table was assigned to each annotation that was matched.
- The annotations were separated into record book entries and calculation book entries

- The calculation books were further filtered to include only water main replacements
- A workbook year was assigned for each water line by finding the nearest workbook label for each water line and extracting the year and distance to the line.
- A calculation book year was assigned for each water line by finding the nearest calc book label and extracting the year and distance to the line
- For each waterline and valve, the estimated installation year was set by the priority scheme listed below
  - GIS installation year if one was included in the GIS.
  - Calc book year if calc book distance was less than 200 feet from main.
  - Record book installation year if distance was less than 900 feet from main.

The above procedure produced estimated ages for 89 percent of the waterlines and 68 percent of the valves. For the remaining water lines and valves with no GIS age information, the average age for pipes or valves of the same size was assigned. Since no information on hydrant ages is available in the GIS, hydrant ages were assigned using the age distribution for valves. For sewers, manholes, and diversions structures that do not have GIS age information, ages were estimated based on weighted average values for the facilities that do have assigned ages. Catch basin ages were assigned using the age distribution for manholes.

Table 3-7 presents depreciated values for water treatment, pumping, and storage facilities. The estimated replacement cost was copied from Table 3-5 and the year installed is based on the date of the most recent upgrade to the facility per Table 3-1. The remaining life was calculated based on the age of a facility relative to its useful life. PWSA uses a 40 year useful life for plant facilities. The depreciated value for the treatment, pumping, and storage facilities is $316.96 million based on the estimated remaining lives of individual facilities. The clearwell is assumed to be fully depreciated due to its age.

Depreciation analyses similar to the one presented in Table 3-7 were conducted for the water distribution and sewer system components. However, the results cannot be easily presented in tabular form due to the large number of lines in the database files. As examples, the spreadsheet with waterline information from the GIS contains about 64,000 lines of data and there are 43,000 lines of sewer line data. As a result, information from the water and sewer line depreciations will be presented in summary form. PWSA uses a

Table 3-7

Water Treatment, Pumping, and Storage Depreciation

Facility	Estimated Replacement Cost	Year Installed *	Remaining Life (percent)	Depreciated Value
Raw Water Intakes	$3,500,000	2009	95.00%	$3,325,000
Ross Pump Station	18,853,000	1986	37.50%	7,069,875
Clarifiers, Filters, and Chem. Feed	131,100,000	1996	62.50%	81,937,500
Sedimentation Basins	37,255,000	1994	57.50%	21,421,625
Clearwell	55,756,000	1908	0.00%	0
Highland Membrane Filtration Plant	15,791,000	2010	97.50%	15,396,225
Subtotal Treatment	262,255,000			129,150,225
Aspinwall Pump Station	14,149,000	1989	45.00%	6,367,050
Bruecken Pump Station	11,726,000	1987	40.00%	4,690,400
Herron Hill Pump Station	4,598,000	1987	40.00%	1,839,200
Herron Hill Tank Pump Station	77,000	1988	42.50%	32,725
Highland Pump Station	1,495,000	1986	37.50%	560,625
Howard Pump Station	8,043,000	1986	37.50%	3,016,125
Inline Pump Station	219,000	1981	25.00%	54,750
Lincoln Pump Station	1,206,000	1986	37.50%	452,250
Mission Pump Station	6,626,000	1988	42.50%	2,816,050
Saline Pump Station	1,693,000	1986	37.50%	634,875
Subtotal Pumping	49,832,000			20,464,050
Herron Hill Reservoir	6,233,000	2007	90.00%	5,609,700
Highland No. 1 Reservoir	62,594,000	1983	30.00%	18,778,200
Highland No. 2 Reservoir	65,210,000	2011	100.00%	65,210,000
Lanpher Reservoir	69,147,000	2007	90.00%	62,232,300
McNaugher Tank No. 1	2,280,000	1998	67.50%	1,539,000
McNaugher Tank No. 2	400,000	1998	67.50%	270,000
Allentown Tank No. 1	1,510,000	1982	27.50%	415,250
Allentown Tank No. 2	1,510,000	1982	27.50%	415,250
Bedford Tank	1,190,000	1993	55.00%	654,500
Brashear Tank No. 1	2,890,000	2010	97.50%	2,817,750
Brashear Tank No. 2	2,890,000	2010	97.50%	2,817,750
Herron Hill Tank	1,360,000	2010	97.50%	1,326,000
Garfield Tank	5,850,000	1992	52.50%	3,071,250
Lincoln Tank	1,590,000	1982	27.50%	437,250
Spring Hill Tank No. 1	390,000	1982	27.50%	107,250
Spring Hill Tank No. 2	390,000	1982	27.50%	107,250
Squirrel Hill Tank	1,540,000	2011	100.00%	1,540,000
Subtotal Storage	226,974,000			167,348,700
Totals	$539,061,000			$316,962,975

* Based on Year of Most Recent Upgrade
Remaining Life is Based on a Total Asset Life of 40 years

Table 3-8

PWSA System Valuation Summary

Category	Estimated Replacement Cost	Depreciated Value
Waterlines	$627,059,000	$150,494,160
Valves	62,277,000	15,818,046
Hydrants	18,715,000	3,390,639
Distribution Subtotal	708,051,000	169,702,845
Treatment	262,255,000	129,150,225
Pumping	49,832,000	20,464,050
Storage	226,974,000	167,348,700
Subtotal Water System	1,247,112,000	486,665,820
Sewers	1,020,543,000	203,808,252
Manholes	164,325,000	57,657,604
Catch Basins	68,204,000	23,897,886
Diversion Structures	9,405,000	1,491,500
Pump Stations	2,400,000	411,429
Subtotal Sewer System	1,264,877,000	287,266,671
Total Water and Sewer Systems	$2,511,989,000	$773,932,491

useful life of 70 years for water and sewer lines. A 70-year useful life for pipelines means that waterlines installed before 1942 will be fully depreciated. Based on the actual and estimated ages for water system components, more than 50 percent of the waterlines and valves fall into this category. The useful lives of waterlines can be extended by applying cement or epoxy coatings to the pipe interior. The United States Environmental Protection Agency (EPA) estimates that cement lining extends the life of a waterline by 50 years and that epoxy linings last for 75 years. The PWSA GIS system does not contain information on pipes that have been relined, so the depreciation analysis was carried out using age information for the pipelines.

Table 3-8 presents a valuation summary for the PWSA water and sewer systems. The table lists estimated replacement costs and depreciated values for PWSA facilities. The water system has an estimated replacement cost of $1.247 billion and a depreciated value of $486.67 million. The sewer system has an estimated replacement cost of $1.265 billion and a depreciated value of $287.27 million. The total estimated replacement cost for the PWSA water and sewer systems is $2.51 billion and the depreciated value of the systems is estimated at $773.93 million.

3.2 WATER SYSTEM NEEDS ASSESSMENT

The performance of the PWSA water distribution was assessed using the PWSA water distribution system model in conjunction with Chester Engineers' experience with PWSA system operations. The PWSA water distribution system model, data collected during the Authority's on-going hydrant testing program, recent Insurance Services Organization (ISO) testing, and evaluations of available system storage versus demand were used to evaluate the ability of the existing water distribution system to meet current water demands and recommended fire flow requirements.

Existing average and maximum day demands by service district are presented in Table 3-9.

Table 3-9
Existing Average and Maximum Day Water Demands

Service District	Average Day Demands (mgd)	Maximum Day Demands (mgd)
Highland 1	14.0	25.1
Inline Pump District	0.2	0.2
Bedford	0.8	2.1
Herron Hill Tank	0.5	0.7
Herron Hill Reservoir	15.8	18.5
Bloomfield Regulator	0.8	0.7

Table 3-9
Existing Average and Maximum Day Water Demands (continued)

Service District	Average Day Demands (mgd)	Maximum Day Demands (mgd)
Lincoln	1.1	2.0
Garfield	3.0	3.5
Highland Park/Garfield Regulator	0.3	0.4
Zoo Regulator	0.1	0.2
Highland 1 Subtotal	*36.6*	*50.0*
Highland 2	9.2	22.2
Allentown	4.8	6.1
Squirrel Hill	2.5	3.1
Highland 2 Subtotal	*16.5*	*28.0*
Lanpher	8.2	21.2
Brashear	3.4	4.2
McNaugher/Spring Hill	5.7	7.5
Lanpher Subtotal	*17.2*	*28.0*
Total Production	70.2	107.0
Note: Maximum day values are not additive to total because service district maximum day events do not coincide.		

Evaluation of Distribution Pumping Capacity

The projected maximum day demands for the service districts were compared to the nominal pumping capacities of the associated pumping stations in order to evaluate the adequacy of the existing pumping facilities under the existing demand conditions. The nominal pump station capacity represents the sum of the rated capacities with one of the largest pumps out of service. This comparison is summarized in Table 3-10.

Table 3-10
Comparison of Existing Demands to Existing Pumping Capacity

Service District	Pump Station	Year 2011 Max Day Demand (mgd)	Pump Station Nominal Capacity (mgd)
Highland 1	n/a	25.10	n/a
Inline Pump District	Inline Pump Station	0.22	0.14
Bedford Herron Hill Reservoir	Herron Hill Reservoir Pump Station	18.50	24.0
Herron Hill Tank	Herron Hill Tank Pump Station	0.65	2.0

Table 3-10
Comparison of Existing Demands to Existing Pumping Capacity (continued)

Service District	Pump Station	Year 2011 Max Day Demand (mgd)	Pump Station Nominal Capacity (mgd)
Bloomfield Regulator	n/a	0.74	n/a
Lincoln	Lincoln Pump Station	1.98	4.0
Garfield	New Highland Pump Station	3.45	4.8
Highland Park/Garfield Regulator	n/a	3.45	n/a
Zoo Regulator	n/a	0.18	n/a
Highland 1 Subtotal	*Bruecken Pump Station*	*50.0*	56.0
Highland 2	n/a	22.20	
Allentown	Mission Pump Station	6.10	26.0
Squirrel Hill	Saline Pump Station	3.10	5.0
Highland 2 Subtotal	*Bruecken Pump Station*	*28.0*	48.0
Lanpher	n/a	21.20	n/a
Brashear	Howard Pump Station	4.20	7.5
McNaugher/Spring Hill	Howard Pump Station	7.50	13.5
Lanpher Subtotal	*Aspinwall Pump Station*	*28.0*	49.0
Nominal Capacity=Rated capacity with largest pump out of service			

As is indicated in Table 3-10, with the exception of the Inline Pump Station, the nominal capacities the pump stations exceed the existing maximum day demand, indicating sufficient pumping capacity. The Inline Pump Station contains two pumps; a 0.14-mgd capacity unit and a 0.29-mgd capacity unit. Consideration should be given to increasing the capacity of the smaller unit to improve system reliability under maximum day demand conditions.

Evaluation of Distribution System Storage Capacity

An evaluation of the adequacy of the distribution system storage capacity was performed under existing demand conditions. The required storage volumes for the storage facilities were determined using two methods. The first method computed the required volume as equivalent to one day of storage under average day demand conditions. The second method computed the required volume based upon the following formula.

The required effective storage is the sum of the following:

- Equalization storage = the volume that equates to the difference between the peak hour system demand and the firm pumping capacity of the supplying station for a 6-hour duration.

- Fire flow volume = the volume equal to a 3,000-gpm flow rate supplied for a 3-hour duration.
- Emergency storage volume = the volume equal to the maximum day demand rate for a 4-hour duration.

The effective storage is set to be available within the upper one-half of the storage facility. Therefore, total storage requirement equals twice the effective storage capacity.

The larger of volumes computed using these two methods was determined to be the required storage volume.

Table 3-11 presents a comparison of the computed storage capacity requirements for each of the distribution system storage facilities. As is indicated in Table 3-11, overall, the PWSA water distribution system has a surplus of capacity. However, deficits in storage capacities under the current demand conditions are identified for the Herron Hill Tank, the Garfield Tank and the Herron Hill Reservoir. The capacity of the Squirrel Hill Tank only marginally satisfies the computed storage requirement and concerns related to the amount and elevations of stored water available in the Squirrel Hill system and the impacts upon system operations and levels of service have existed for some time.

Table 3-11
Evaluation of Distribution System Storage Capacity – Existing Conditions

	Existing Storage (Mgal)	Required Storage Mgal	Surplus/Deficit (Mgal)
Highland 1 Reservoir	130.5	Included in subtotal	
Bedford Tank	2.1	1.8	0.3
Herron Hill Reservoir	14.0	15.8	-1.8
Herron Hill Tank	0.4	1.7	-1.3
Lincoln Tank	3.0	1.8	1.2
Garfield Tanks	2.0	3.0	-1.0
Highland 1 Reservoir Subtotal	152.0	36.6	115.4
Highland 2 Reservoir	125.0	Included in subtotal	
Allentown Tanks	6.0	4.8	1.2
Squirrel Hill Tank	3.0	2.5	0.5
Highland 2 Reservoir Subtotal	134.0	16.5	117.5
Lanpher Reservoir	133.0	Included in subtotal	
Brashear Tanks	11.0	3.4	7.6
McNaugher/Spring Hill Tanks	6.4	5.7	0.7
Lanpher Reservoir Subtotal	150.4	11.7	138.7
Note: Water stored in the Highland 1 Reservoir cannot be used unless the Membrane Filter Plant is operational and can only be used at a rate within the treatment capacity of the MFP.			

Assessment of Overall Distribution System Performance Under Current Conditions

The PWSA water distribution system model was used to evaluate system performance under current conditions. This analysis was completed by simulating system operation under the current average day and maximum day demand conditions. The average day and maximum day model simulations were performed and the results of the modeling were reviewed in order to evaluate system performance.

General system performance was evaluated based upon the ability of the distribution system to maintain operating pressures in the distribution grid at or above 35-psi under the average day demand conditions and above 20-psi under the extreme maximum day demand conditions. The results of this evaluation are illustrated in Figures 3-1 and 3-2. Figure 3-1 and Figure 3-2 present the results for the average day and maximum demand conditions, respectively. The working pressure performance targets are met at 99-percent of the 20,000+ model nodes. Exceptions to this predominantly occur at high elevations adjacent to storage facility locations and do not impact the levels of service experienced by the customers.

Other isolated instances of excursions occur at the highest elevations in service areas that are typically served by smaller diameter, older mains. These situations likely can be addressed by making minor adjustments to pressure district boundaries that entail minimal capital costs and/or through the replacement of small/old mains as part of an ongoing water main replacement program. These results indicate that no major new water main transmission projects are required to meet current demands.

Although the working pressure performance targets are generally met and no major new transmission main construction is required, there are two specific areas within the distribution system in which service pressures have been an issue. The first low pressure area of concern is in the Borough of Millvale. Properties in Millvale at higher elevations report pressures as low as 30-psi. Millvale is currently supplied from the PWSA 60-inch main on East Ohio Street and the volume of supply is more than adequate. However, pressures in the 60-inch main are insufficient to adequately reach the higher elevations in the Borough. It is currently proposed that the problematic higher elevation areas in Millvale be supplied by constructing a booster pump station. The associated necessary improvements are described in Section 4.

The second area consists of an area in Bloomfield along Penn Avenue roughly between 44th Street and Fairmount Street, along Friendship Avenue between Atlantic Avenue and Emory Way and along Harriet Street between Gross Street and Graham Street. This is an active redevelopment area in which existing customers report persistent low pressure problems. The area is served by the Highland 1 Reservoir District, but is immediately adjacent to the Bloomfield Regulator District. Expanding the Bloomfield Regulator

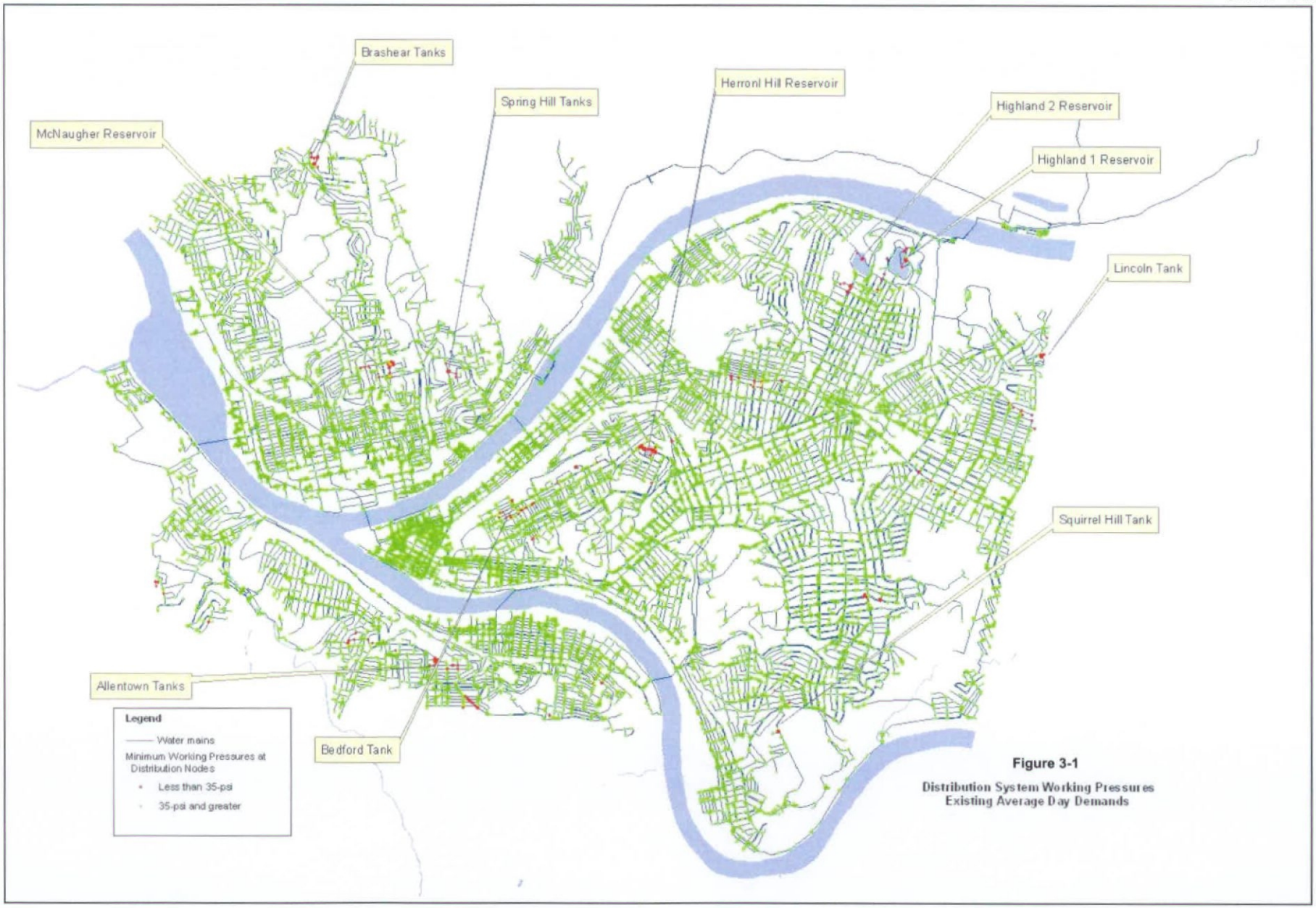


Figure 3-1

Distribution System Working Pressures
Existing Average Day Demands

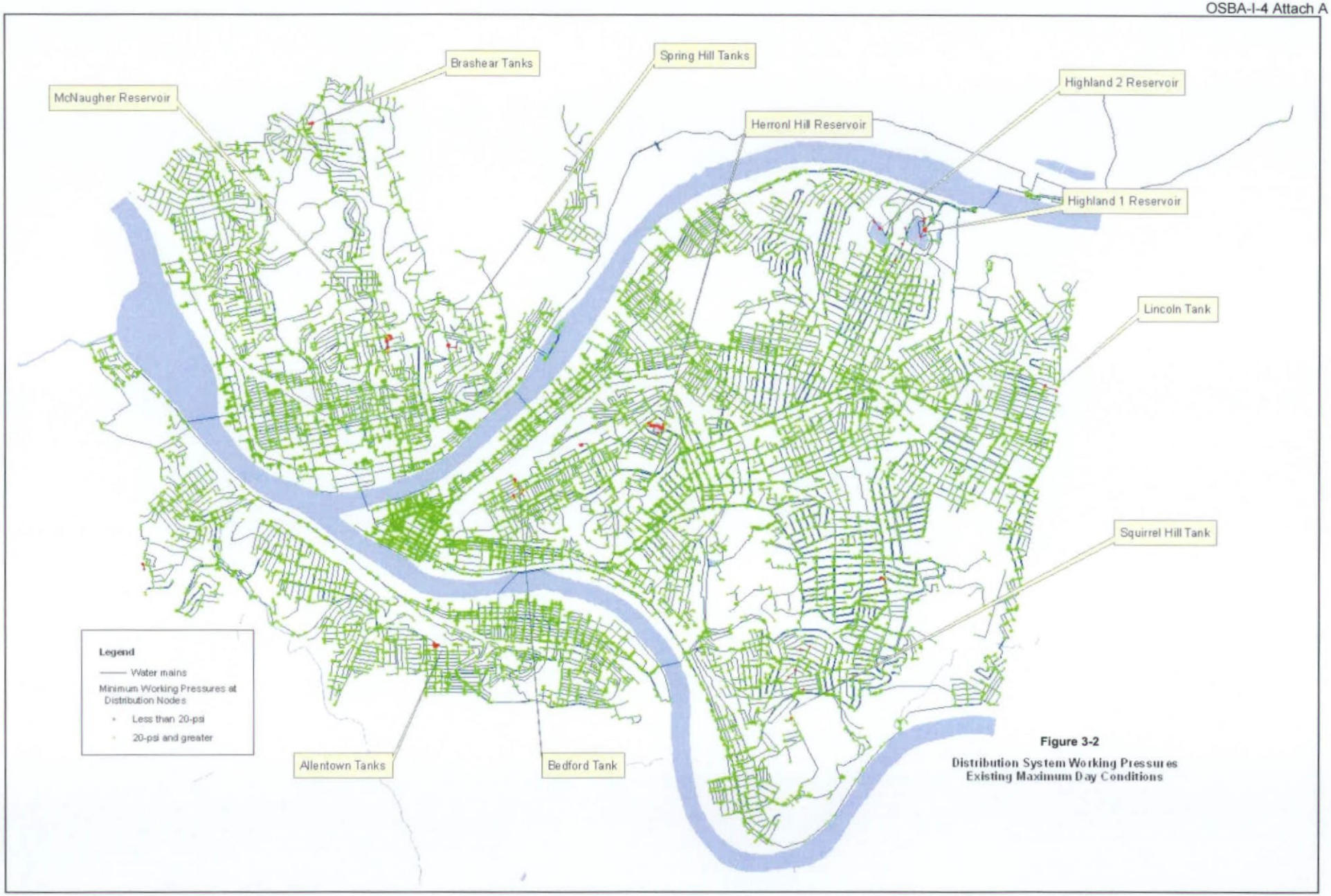


Figure 3-2

Distribution System Working Pressures
Existing Maximum Day Conditions

District has been identified as a feasible means of sufficiently increasing service pressures in this area. The associated necessary improvements are described in Section 4.

Expanding the Bloomfield Regulator district would shift approximately 0.75-mgd of water demand from the Highland 1 Reservoir District to the Herron Hill Reservoir District under maximum day demand conditions. The Herron Hill District is currently taxed and there is a concern that shifting this amount of demand to the Herron Hill Reservoir District will place too great a demand on the facilities. As was presented previously in Table 3-11, the projected year 2011 demand on the Herron Hill Reservoir Pump Station under the service area current configuration is approximately 21.7-mgd. Adding the Bloomfield demand would increase the total demand to 90-percent of the nominal rated capacity of the station. A concept that has been advanced for addressing this situation consists of expanding the Lincoln Service District into a portion of the Herron Hill Reservoir District. This modification to the configuration of the PWSA water distribution system would reduce the demand on the Herron Hill Reservoir Pump Station and Herron Hill Reservoir by reducing the size of the district served. It would also offer the benefits of expanding the Lincoln Tank District into higher elevation areas of the Herron Hill Reservoir District and improve working pressures and creating an emergency secondary feed to the Squirrel Hill District from the Lincoln District. Expansion of the Lincoln District as envisioned would shift approximately 4.5-mgd of demand under maximum day conditions from the Herron Hill Reservoir District to the Lincoln District. As is described in Section 4, this expansion would require the construction of a transmission main from the Lincoln District into the expanded service area, upsizing the Lincoln Pump Station, and adding storage to the Lincoln District.

Assessment of Fire Flow Delivery Capacity

An assessment of the fire flow delivery capacity of the distribution system was performed using a combination of computer modeling and the results of the PWSA's on-going field hydrant flow testing program. Fire flow delivery capacity is defined as the rate of flow (usually expressed in terms of gallons per minute (gpm) that can be delivered by the distribution system to specific hydrant locations at a 20-psi residual pressure in the mains. Estimates of the fire flow delivery capacities at the approximate locations of hydrants throughout the system under average day demand conditions were produced by computer modeling. The modeled hydrant flow capacities are illustrated in Figure 3-3. Field measured hydrant flow capacities at locations tested by either the PWSA or the Pittsburgh Bureau of Fire are illustrated in Figure 3-4. The general patterns of variations in hydrant flow capacities are generally similar for the modeled and field test results. However, the field tests are more precise measurements that more accurately reflect local pipe conditions that have significant impacts on flow capacity and typically result in lower than modeled capacities in older, smaller diameter areas of the water distribution system. Table 3-12 summarizes the results of the field testing program.

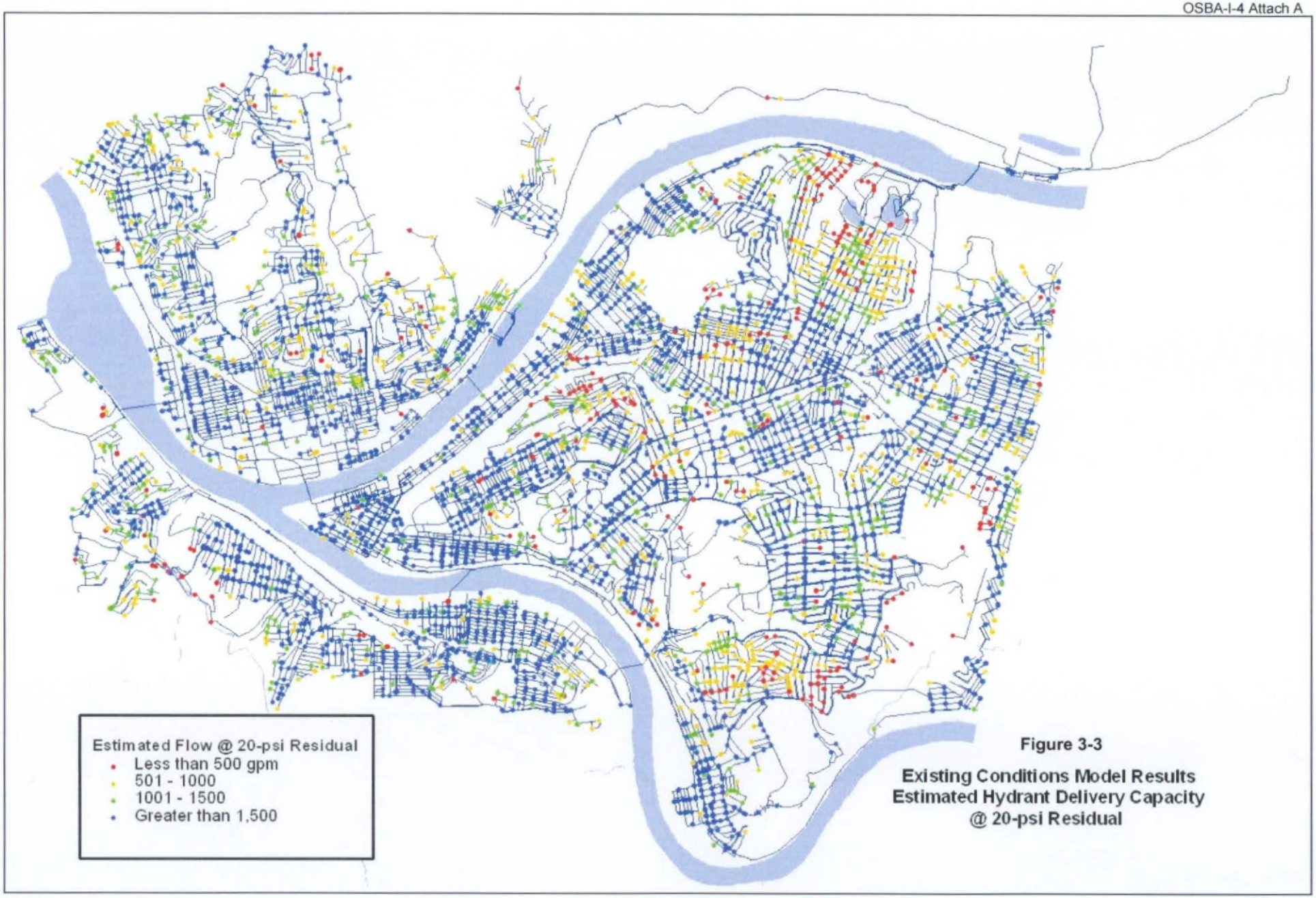


Figure 3-3

Existing Conditions Model Results
Estimated Hydrant Delivery Capacity
@ 20-psi Residual

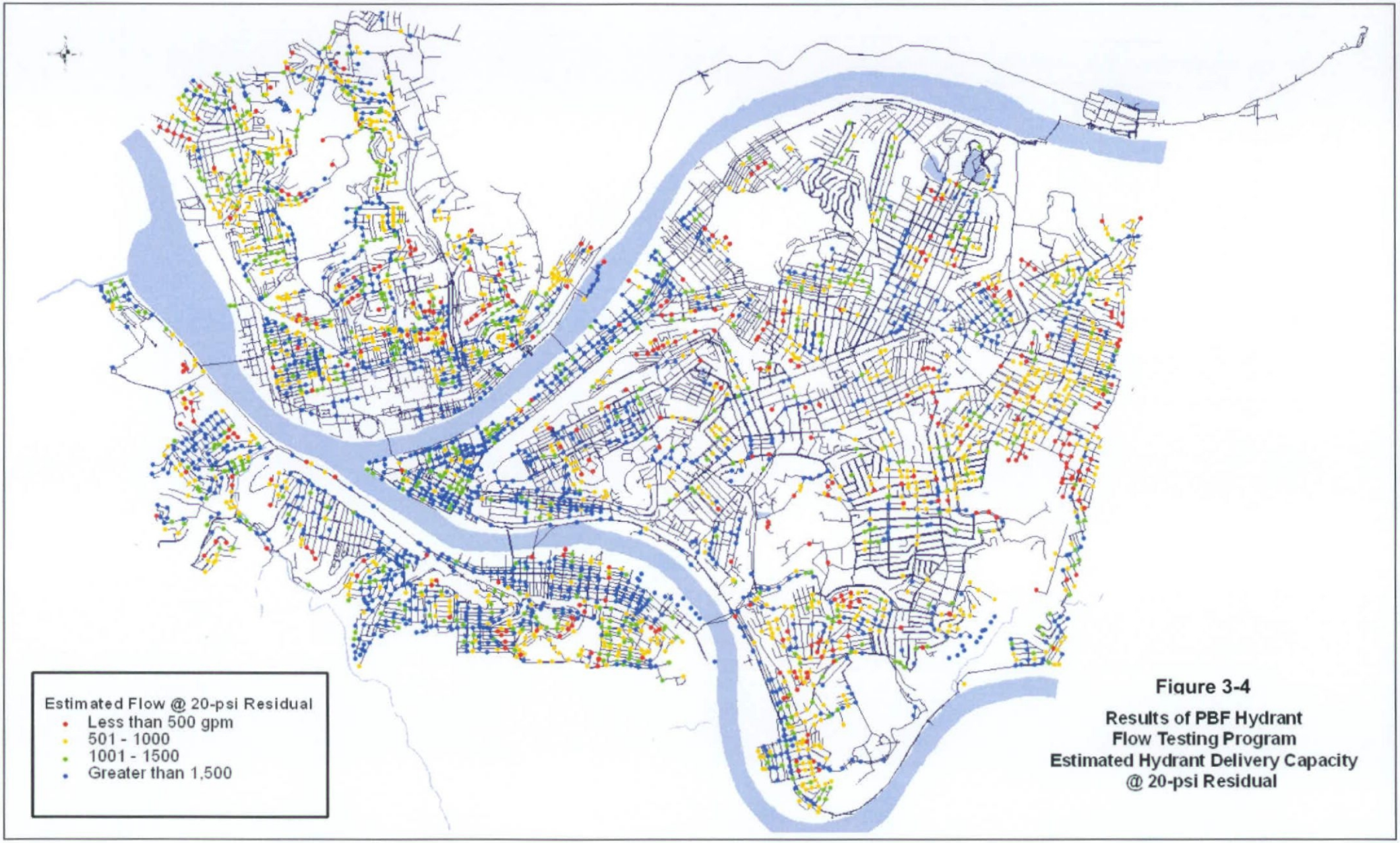


Figure 3-4

Results of PBF Hydrant Flow Testing Program
Estimated Hydrant Delivery Capacity @ 20-psi Residual

Table 3-12
Summary of Field Test Hydrant Flow Capacities

Flow Capacity at 20-psi Residual Pressure (gpm)	Percent of Hydrants Tested
500 and less	9.4%
500 to 1,000	28.5%
1,000 to 1,500	18.1%
more than 1,500	44.0%

During 2011, the Insurance Services Organization (ISO) completed an analysis of the City of Pittsburgh's fire suppression delivery system. This included assigning recommended available fire flows for selected structures throughout the city, completing hydrant flow tests at 153 locations to determine the fire flow capabilities of the system and determining whether the system fire flow delivery capacity meets the recommended fire flows. The ISO measured fire flow capacities are illustrated in Figure 3-5. The ISO analysis concluded that the fire flow capacities of the distribution equaled or exceeded the recommended fire flows at 79-percent of the tested locations.

The target minimum performance level for available fire flow capacity is 500-gpm. Fewer than 10-percent of the Pittsburgh Bureau of Fire's field tested hydrants in the system exhibit flow capacities less than 500-gpm. Investigations performed pursuant to receipt of hydrant flow test results have determined that nearly all of the low fire flow capacity hydrants are located on dead end mains and/or in areas served by small diameter, usually older pipes. These investigations have demonstrated that the replacement of local, old, small diameter pipes will be effective in significantly increasing fire flow capacities. The instances of low fire flow capacities can be addressed as aging water mains are replaced. As is discussed later in this report, the water main replacement program considers the proximity to low capacity hydrants in prioritizing mains for replacement.

3.3 ADDITIONAL CONCERNS

Additional areas of concern regarding the water system were discussed with PWSA staff at the February 22, 2011 progress meeting. Based on discussions at Progress Meeting No. 5, the following items are to be addressed in the 40-Year Plan:

- WTP clearwell rehabilitation/replacement.
- Transfer pump station - Highland 2 reservoir to Highland 1 district.
- Second storage tank for Squirrel Hill pressure district.
- Low water pressure in the Penn Avenue area of Bloomfield/Garfield.

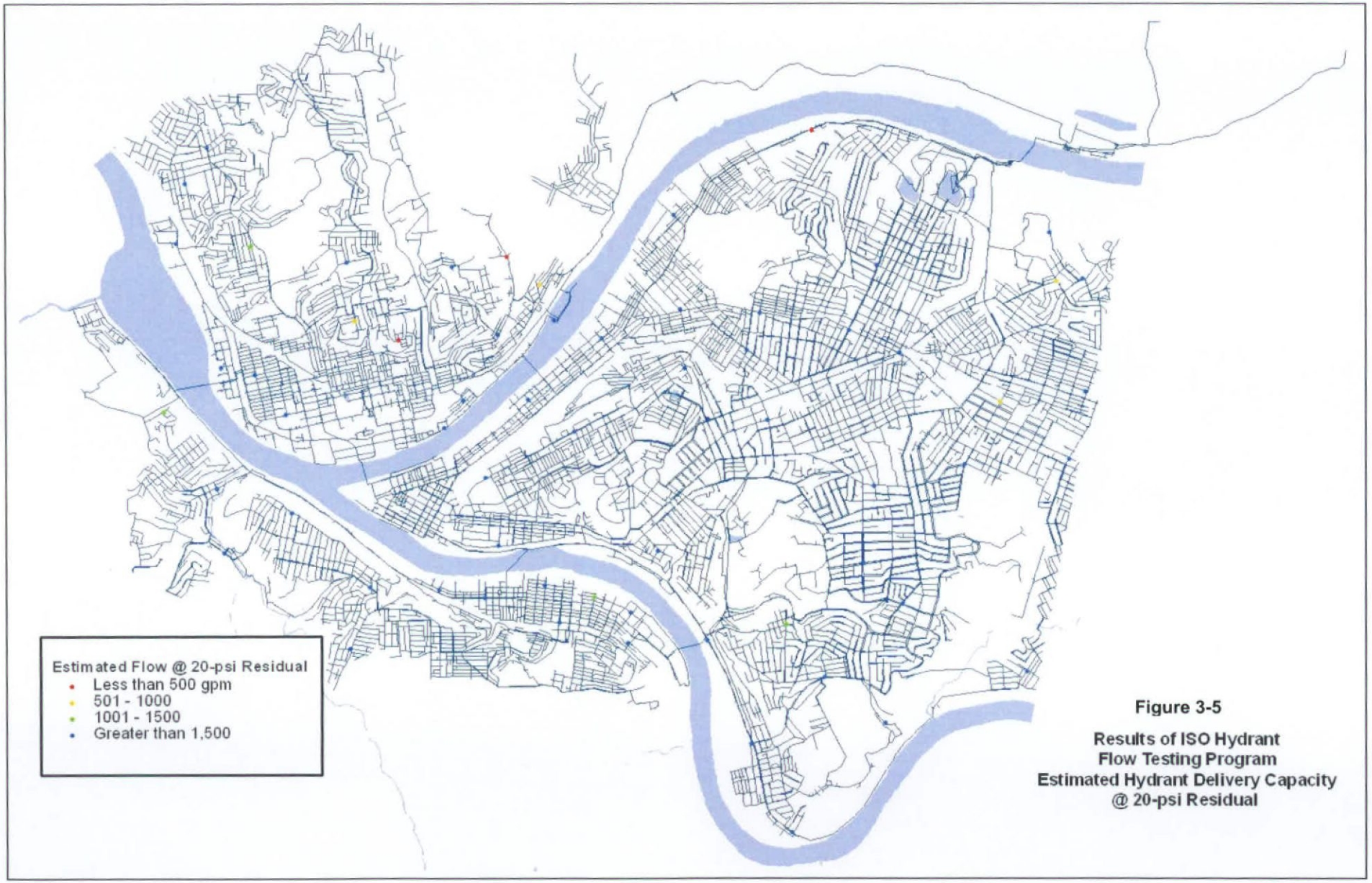


Figure 3-5

Results of ISO Hydrant Flow Testing Program Estimated Hydrant Delivery Capacity @ 20-psi Residual

- Increasing water demands in Herron Hill pressure district.
- Safe Drinking Water Act Compliance and TTHM reduction.
- Reducing non-revenue water through leak detection and repair.
- Prioritized water main replacement program.
- Service to PA American portion of City.
- Access tunnel at water treatment plant.
- License to pursue hydropower.

Much of the mechanical equipment, electrical equipment, and instrumentation at PWSA facilities is advanced in age. There is also a need for rehabilitation and improvements to the water treatment plant facilities and equipment. Recommended improvements to the water treatment plant are discussed in Task 4.3. Task 4.11 describes and provides concept level cost estimates for improvements to PWSA distribution, pumping, storage, and treatment facilities.

With regards to the need for backup power supplies or sources, PWSA authorized CDM to develop construction documents for a standby power project at the Bruecken Pump Station. The primary improvements included the addition of a 21 mgd capacity constant speed "trim" pump and two standby emergency generators with sufficient capacity to start and operate any two pumps during a complete power outage. A 90% Design Report prepared by CMD and dated June 2008 presented a $6.98 million construction cost estimate for the project. Facilities are currently being installed at Bruecken to accommodate the temporary hook-up of emergency generators.

PWSA has two portable generators to provide back-up power to the booster chlorination systems at water storage sites. Emergency power is primarily needed at locations where a higher amount of disinfection product is used. This would include Highland 2 Reservoir, Lanpher Reservoir, and Herron Hill Reservoir. PWSA operating staff would like to see automatically controlled (start and stop) generators permanently installed at these three sites.

Information on each of the bulleted items above is presented in the following sections.

WTP Clearwell Rehabilitation / Replacement

The 44 million gallon capacity clearwell was constructed around 1908 and is used to disinfect the filtered water produced at the Aspinwall water treatment plant. Water from the clearwell feeds the Aspinwall and Bruecken finished water pump stations. The clearwell is a weak link in the water treatment and distribution system because there is no practical way to take any portion of the clearwell out of service for maintenance or repair. If the clearwell became non-functional for any reason, the main source of potable water for PWSA customers would be interrupted.

Two parallel studies were prepared for clearwell improvements at the Aspinwall water treatment plant. HDR Engineering, Inc. prepared one report in November 2008 and Malcolm Pirnie, Inc. prepared a second report in December 2008. The HDR report evaluated the three alternatives listed below:

- Alternative 1 – Construct Permanent Clearwell in Existing Sedimentation Basin.
- Alternative 2 – Construct Permanent Clearwell on Aspinwall Pump Station Site.
- Alternative 3 – Install UV as Primary Disinfection Method.

Based on an evaluation of both cost and non-economic factors, HDR recommended that PWSA proceed with Alternative 1. Alternative 1 has a total estimated project cost of $68.574 million and includes the following components:

- Conversion of the central receiving basin to a finished water clearwell.
- Installation of a pump station and transmission main to convey filtered water to the new clearwell.
- Construction of a gravity line from the new clearwell back to the Aspinwall and Bruecken pump stations (will also serve as a bypass for the existing clearwell).
- Installation of variable speed drives on the Aspinwall and Bruecken pumps.
- Rehabilitation of the existing clearwell.
- Increased utilization of existing system storage at the Highland Reservoirs.

The Malcolm Pirnie report identified the top three most desirable alternatives as follows:

- Alternative 3a(1) – Convert the West Sedimentation Basin to a Temporary Clearwell and Rehabilitate the Existing Clearwell.
- Alternative 3b – Obtain CT in Sedimentation Basins and Rehabilitate the Existing Clearwell (CT = product of free chlorine residual and contact time).
- Alternative 3c – Combined Filter Effluent (CFE) Ultraviolet (UV) System and Rehabilitate the Existing Clearwell.

Based on pairwise and cost evaluations, Malcolm Pirnie identified Alternative 3c as the preferred alternative. Alternative 3c has a total estimated project cost of $68.664 million and includes the following major items:

- Clearwell Sediment Removal and Structural Inspection
- CFE UV Facility and Equalization Basin Construction
- Finished Water Pump Station VFD and Motor Upgrades

- Clearwell By-Pass Piping Modifications
- Clearwell Rehabilitation

PWSA staff suggested at the February 22, 2011 progress meeting that the 40-Year Plan should include costs for the most reasonable option for clearwell improvements. Estimated project costs for the HDR and Malcolm Pirnie recommended alternatives are virtually identical. Therefore, the estimated $52,817,000 construction cost associated with the Malcolm Pirnie alternative will be included in the 40-Year Plan for improvements to the clearwell.

Transfer Pump Station – Highland 2 to Highland 1 District

PWSA is investigating a transfer pump station to send water from Highland 2 reservoir to the Highland 1 district. This pump station would primarily be used to supplement the supply to the Highland 1 district during periods when demands exceed the capacity of the membrane filtration plant. The transfer pump station is discussed under Task 4.1.

Second Storage Tank for the Squirrel Hill Pressure District

The Squirrel Hill tank is scheduled to be painted this year but will be difficult to take out of service. It was suggested that the tank should be isolated so the tank condition can be evaluated prior to painting. If the inspection reveals that the tank is nearing the end of its useful life, the tank should be replaced.

The Squirrel Hill tank is a standpipe but should really be an elevated tank because the water in the bottom of the tank is of no use. If the water level drops below a certain level, part of the service area loses pressure. A second Squirrel Hill tank would take a load off the Herron Hill reservoir. Options for Squirrel Hill would be to add a second tank or replace the existing standpipe with an elevated tank. The 40-Year Plan recommends construction of an elevated tank to replace the existing Squirrel Hill tank.

The need for a second water storage tank in the other pressure districts that have a single tank (Lincoln, Garfield, and Herron Hill) was also discussed. It is recommended that redundant tanks be provided wherever possible to improve service.

Low Water Pressure in the Penn Avenue Area of Bloomfield/Garfield

Low water pressure in the Bloomfield/Garfield area could be addressed by changing the boundary of the Bloomfield regulator district. The recommended method of addressing this problem is described under Task 4.1.

Increasing Water Demands in the Herron Hill Pressure District

There is concern that demands in the Herron Hill District are growing and stressing the PWSA system. This district serves a large area including Oakland and all of the university and hospital facilities located there. The main water storage facility in the district, the Herron Hill Reservoir, is supplied by the Herron Hill Pump Station. The Herron Hill Pump Station is supplied from Highland 1 Reservoir. Since Highland 1 Reservoir is currently uncovered, all water coming from the reservoir must be re-treated in the membrane filtration plant before it can be pumped to the distribution system. The capacity of the membrane plant was recently increased from 20 to 26 mgd but the plant is still the biggest bottleneck in the PWSA system. Operational and reliability issues with the membrane plant equipment can also cause the output from the facility to be less than its rated capacity.

One way to improve supply to this area would be to carve out a portion of the Herron Hill Service District and move it to the Lincoln District. This alternative is discussed in more detail under Task 4.1.

Safe Drinking Water Act Compliance and TTHM Reduction

Alternative methods to reduce total trihalomethanes (TTHMs) in the PWSA system were discussed at the January 4th and March 29th progress meetings. Disinfection byproduct (DBP) control strategies include the three general approaches shown below. Alternative methods of control are listed beneath each general approach:

a. Removal of Organic DBP Precursors
    1. Enhanced coagulation
    2. Peroxide / Biological Activated Carbon
    3. Granular Activated Carbon in Existing Filters
    4. Granular Activated Carbon in New Filters
    5. Granular Activated Carbon Absorbers
    6. Nanofiltration
    7. Ozone / Biological Active Filtration
    8. Ozone / Biological Activated Carbon
    9. MIEX Ion Exchange
b. Alternative disinfectants and / or conditions
    1. Chlorine dioxide

2. Ozone
3. Chloramines

c. Remove after Formation

1. Granular Activated Carbon
2. Reverse Osmosis
3. Biologically Active Carbon
4. Air Stripping

PWSA has undertaken numerous steps to reduce TTHM concentrations in finished water. These steps include eliminating pre-chlorination of the raw water entering the treatment plant, lowering turbidity to reduce total organic carbon (TOC), practicing enhanced coagulation, decreasing the amount of stored water to reduce water age, and optimizing the system. A small amount of chlorine is added just before the filters to remove manganese.

The maximum contaminant level (MCL) for TTHMs is 80 micrograms per liter (ug/L). TTHM concentrations in the PWSA system are generally in the high 60s but concentrations in Reserve Township are close to the 80 ug/L limit. PWSA is currently meeting Stage 1 requirements for TTHMs but Stage 2 will require sampling at 12 sites instead of 4. Mandatory testing began in April 2012. It is believed that 20 percent TTHM removal would allow PWSA to meet the requirements for Stage 2 but there will be violations if TTHM levels can't be reduced at the storage tanks.

A flushing program can be used to reduce TTHMs. Automatic flushers can be installed on fire hydrants to bleed water from dead end lines. PWSA doesn't have a flushing program at the present time. Another way to reduce TTHMs would be to install a UV disinfection system at the treatment plant and use less chlorine.

PWSA can't use an alternative disinfectant such as chloramines because a corrosion inhibitor can't be added to the water due to the open Highland Park No. 1 reservoir. Without a corrosion inhibitor, the use of chloramines would cause lead violations.

Air stripping appears to be the most promising method of reducing TTHM concentrations from water in storage facilities. A literature review indicates that aeration can remove 70 to 90 percent of TTHMs. PWSA is working with PAX Technologies and Dr. Casson at the University of Pittsburgh to install a demonstration system at the Brashear tanks. The Brashear tanks are located near the sampling point that has the highest measured TTHMs. One of the two tanks was painted recently and is still off-line. The demonstration system will be installed in this tank. PWSA plans to sample the water entering and exiting the tank at two week intervals to determine what kind of TTHM reductions are possible with the PAX system. Additional vents may have to be added on the top of the tank to provide the required amount of air exchanges for the system. Both Brashear tanks are currently

equipped with Red Valve systems to prevent stratification. The PAX system will add a mixer.

Reducing Non-Revenue Water Through Leak Detection and Repair

This subject is discussed under Task 4.7.

Prioritized Water Main Replacement Program

The Cap Plan software program was used to develop a risk based water main replacement/rehabilitation program. The main replacement program is described in detail under Task 4.2.

Service to Portion of City Served by PA American Water

The 40-Year Plan needs to address the potential for serving the portion of the City currently serviced by PA American. The facilities needed to provide service will have to be in place in order for PWSA to take over service to the South Hills.

Monthly water billing records for City customers served by PA American water were analyzed from 2005 through 2010 to determine water demands in this potential service expansion area. Results for the analysis are contained in Appendix 3.7. Metered usage during this period averaged 4.11 mgd. There were approximately 20,304 customers in this service area during the period of review. Adjusting for "unaccounted for" and "other" water uses (40 percent) results in an average water demand of 6.84 mgd for this service area. The maximum day demand for the PA American service area of the City would be about 10.95 mgd based on the 1.60 peaking factor that is experienced in the Allentown service district.

Task 2.3 discussed the cost of extending service to serve the South Hills area. A conceptual analysis of the cost of providing water service to City of Pittsburgh customers that are currently served by PA American Water Company is included as Appendix 2.2. An assessment of the viability of extending PWSA service to the South Hills area is contained in Task 4.4.

Access Tunnel at Water Treatment Plant

The Aspinwall water treatment plant has a tunnel that passes under old Route 28 and the railroad tracks and provides emergency access to and from the plant site. The tunnel is approximately 350 feet long by 12 feet wide and extends from the parking lot of the Waterworks Mall to the eastern edge of the water treatment plant property. Locked gates are present on both ends of the tunnel to prevent unauthorized access to the plant. The tunnel includes a paved road surface and vertical concrete retaining walls along its entire

length. The walls vary in height and are tallest adjacent to the bridges. The structure is truly a tunnel in the two locations where bridges span the retaining walls. The larger of the two bridges carries vehicles on Freeport Road and train traffic for the railroad. The smaller bridge is for the road in front of the water treatment plant. Outside of the bridge areas, the tunnel resembles an open top box culvert.

The tunnel walls have cracks and spalling concrete in different locations but otherwise appear to be in good condition. The bridges seem to be in fair condition, with the smaller bridge looking to be in better shape than the larger one. There is some concrete spalling and cracking on both bridges and support beams for the bridge decks are rusted, particularly on the larger bridge. A leaking water line that discharges into the tunnel area also needs to be fixed.

Based on a cursory inspection, the access tunnel outside of the bridge areas could be rehabilitated by removing accumulated sediment from the road surface and making spot repairs to damaged concrete on the vertical walls. It is anticipated that PWSA will only be responsible for a portion of the cost to rehabilitate the tunnel. PennDOT and the railroad likely own the larger bridge. The City of Pittsburgh or PWSA may own the smaller bridge closest to the water treatment plant property.

License to Pursue Hydropower

PWSA authorized Tetra Tech to conduct a feasibility review for a hydroelectric plant at the Allegheny Lock and Dam 2 (Highland Park Dam). A preliminary review that was prepared in April 2012 indicates that a hydroelectric power plant is feasible at this location. The Tetra Tech technical memorandum stated that the project could be developed for an estimated capital cost of $25 million. Operating costs for a facility of this size are projected to be $900,000 per year and the amount of time needed to permit and construct the facility is estimated at 7 to 9 years.

An installation with two 4 MW turbines would generate approximately 53 GWh/year. This is close to the amount of electricity used by PWSA on an annual basis. The cost analysis contained in the feasibility review projected that annual revenues from power sales would exceed the annual debt service and O&M costs for the hydroelectric facility. Power produced by the facility could be used by PWSA to offset purchased power from the local utility by use of net metering. A less attractive alternative would be to develop a power purchase agreement (PPA) with the local utility.

The feasibility review was based on the premise that PWSA could proceed with a hydropower project at the Highland Park Dam. However, a permit is needed in order to develop a project. Free Flow Power (FFP) Missouri 12, LLC is the holder of the Preliminary Permit to investigate the development of a hydroelectric project at this location. A preliminary permit was issued to FFP Missouri 12, LLC, for the Allegheny Lock and Dam 2 Hydroelectric Project No. 13755-000. The permit is effective April 1,

2011 and ends on April 1, 2014 or on the date that a development application submitted by FFP has been accepted for filing, whichever occurs first.

A hydropower project could be developed in conjunction with FFP or PWSA could purchase the rights to the permit from FFP and develop its own project. If a joint project were developed with FFP, project related costs and revenues would be shared by the two parties. If rights to the permit were purchased, PWSA would have to make a monetary payment to FFP. Either of these arrangements would affect the cost projections contained in the feasibility review. Therefore, PWSA will need to re-evaluate the financial feasibility of the project based on the results of any future discussions with FFP.

3.4 MODEL FUTURE NEEDS

Future pumping and distribution needs were determined using the PWSA water distribution system model in conjunction with Chester Engineers' experience with PWSA system operations. The PWSA water distribution system model, data collected during the Authority's on-going hydrant testing program, and evaluations of available system storage versus demand were used to evaluate the ability of the water distribution system to meet projected future demands and acceptable fire flows at acceptable operating pressures.

Projected Water Demands

These evaluations were performed using 2051 water demands. The projection of future water demands was based upon population projections developed by the Southwestern Pennsylvania Commission (SPC). The SPC "Cycle 8" forecast (adopted by SPC in June, 2007) was used. This data provides population estimates for 36 Pittsburgh "neighborhood clusters" through the year 2035. These estimates were extrapolated to the year 2051 using the trends presented in the projections. Table 3-13 presents the estimated changes in population for City of Pittsburgh neighborhood clusters (as defined by SPC) and the municipalities of Reserve and Millvale.

These population projections were used as the basis for estimating future water demands. This was accomplished by apportioning the projected changes in population between the years 2010 to 2051 within each of the municipalities/neighborhood clusters to the appropriate PWSA water service districts. The resulting net change in service population was multiplied by 140 gallons per capita per day (gpcd) factor to produce estimates of the associated net change in average daily water consumption. The 140 gpcd factor was determined from analyses of billing and pumping records and includes domestic consumption plus allowances for associated increases in commercial, industrial and institutional consumption. The projected changes in future demands were added to the existing average day demands in each of the PWSA service districts to produce projected year 2051 average daily demands. In order to project future maximum day demands, the projected changes in average day demands for each service district were multiplied by an

average day to maximum day peaking factor that was determined from pumping data for the period 2007 through 2009.

Table 3-13
SPC Cycle 8 Population Projections by Municipality or Pittsburgh Neighborhood Cluster *

Municipality (or Pittsburgh neighborhood cluster)	Population Estimates by Year						
	SPC Cycle 8 Estimates						Extrapolated
	2005	2010	2020	2025	2030	2035	2051
01:Golden Triangle/Civic Arena	2,637	2,769	2,934	3,059	3,134	3,129	3,337
02:Central Oakland	4,891	4,904	4,980	4,859	4,728	4,593	4,180
03:North Oakland	9,717	9,765	10,139	10,468	10,875	11,395	12,735
04:West Oakland/South Oakland	5,028	4,956	5,029	5,207	5,424	5,705	6,426
05:Bluff	6,303	6,275	6,305	6,348	6,413	6,501	6,710
06:Strip District	259	262	286	305	329	359	437
07:Bedf Dw/Craw/Middle Hill/Terr Vill	10,475	9,896	9,560	9,648	9,821	9,547	9,533
08:Lawrenceville/Polish Hill	11,189	10,851	10,761	10,950	10,662	10,200	9,602
09:Bloomfield/Garfield/Friendship	15,129	14,755	14,978	15,472	15,620	15,211	15,460
10:Shadyside	13,390	13,525	14,485	14,497	14,507	14,505	14,526
11:East Liberty/Larimer	8,605	8,365	8,676	9,113	9,682	10,425	12,291
12:Stanton Hgts/Morningside/Hghlnd Pk	14,283	14,021	14,467	14,548	14,055	13,552	12,576
13:Lincoln/Lemington/Belmar	5,163	5,032	5,062	5,188	5,361	5,604	6,182
14:Homewood/East Hills	12,119	11,811	12,197	12,761	13,499	14,470	16,895
15:Point Breeze	7,540	7,429	7,733	7,889	7,644	7,393	7,030
16:Squirrel Hill North	11,228	11,348	12,021	12,250	12,171	12,084	12,151
17:Sq Hill South/Regent Sq/Swissh Prk	16,347	16,286	17,280	18,276	19,500	21,054	25,080
18:Greenfield/Hazelwood/Glen Hazel	12,967	12,619	12,663	12,980	13,426	14,157	15,751
19:North Shore	285	305	365	388	396	404	446
20:Chateau	69	65	62	62	61	61	60
21:Manchestr/Cent North Sid/Allegheny	9,798	9,514	9,698	10,064	10,552	10,388	11,124
22:Marshall-Shadeland/Brighton Hgts	14,320	14,194	14,653	15,199	15,467	15,231	15,848
23:Perry South/Northview Hgts	7,294	7,232	7,731	8,230	8,857	9,660	11,718
24:Finev/Sp Hll/Troy Hl/Spring Grdn	7,958	7,751	7,811	8,030	8,332	8,768	9,789
25:Perry North/Summer Hill	5,423	5,348	5,505	5,717	6,003	6,452	7,462
26:South Shore	59	58	57	56	55	55	53
27:South Side Flats/South Side Slopes	10,014	9,747	9,699	9,886	10,246	10,788	11,950
28:Fairywood/Sheraden/Windgap/Esplen	8,639	8,236	8,123	8,297	8,557	8,934	9,799
29:W End/Elit/Wstwood/Crf Hghts/Oakwd	11,975	11,734	11,872	12,211	12,718	13,551	15,342
30:Duquesne Hgts/Mt Washington	11,808	11,547	11,635	12,086	12,148	11,667	11,701
31:Allentown/Beltzhoovr/Knoxv/Bon Air	10,528	10,320	10,630	11,075	11,311	11,115	11,632
32:Arlin/Arlin Hgts/St Clair/Mt Olivr	3,674	3,442	3,382	3,472	3,607	3,800	4,246
33:Banksville/Beechview	12,549	12,304	12,496	12,992	13,615	13,057	13,655
34:Brookline	13,440	13,147	13,221	13,602	14,269	13,668	14,145
35:Carrick/Overbrook	13,732	13,391	13,438	13,763	14,254	14,039	14,680
36:Hays/Lincoln Place/New Homestead	4,773	4,686	4,752	4,912	5,179	5,522	6,343
Millvale Borough	3,831	3,805	3,981	4,172	4,417	4,783	5,638

Table 3-13
SPC Cycle 8 Population Projections by Municipality or Pittsburgh Neighborhood Cluster (continued) *

Municipality (or Pittsburgh neighborhood cluster)	Population Estimates by Year						
	SPC Cycle 8 Estimates						Extrapolated
	2005	2010	2020	2025	2030	2035	2051
Reserve Township	3,751	3,748	3,871	4,000	3,895	3,747	3,615
Fox Chapel Borough	5,371	5,481	5,990	6,082	6,032	5,977	5,963
Totals	326,561	320,924	328,528	338,114	346,822	351,551	376,109
Percent Change 2010 to 2051	17.20%						

* Per 2000 US Census Data. Pittsburgh ranks fourth among large US cities for the highest increase in population during the workday. The City's population of 334,563 increases by 41.3 percent to 472,754 persons in the daytime as a result of the large number of commuters that work in the City.

Existing and estimated water demands by service district are listed in Table 3-14.

Table 3-14
Existing and Projected Average and Maximum Day Water Demands

Service District	Average Day Demands			Maximum Day Demands		
	Existing (mgd)	Year 2051 (mgd)	Percent Change	Existing (mgd)	Year 2051 (mgd)	Percent Change
Highland 1	14.0	15.7	11.6%	25.1	28.01	11.6%
Inline Pump District	0.2	0.2	1.4%	0.2	0.22	1.4%
Bedford	0.8	0.8	0.1%	2.1	2.10	0.1%
Herron Hill Tank	0.5	0.5	-0.6%	0.7	0.65	-0.6%
Herron Hill Reservoir	15.8	16.7	6.0%	18.5	19.61	6.0%
Bloomfield Regulator	0.8	0.8	0.9%	0.7	0.75	1.2%
Lincoln	1.1	1.1	7.1%	2.0	2.12	7.1%
Garfield	3.0	2.9	-2.1%	3.5	3.38	-2.1%
Highland Park/Garfield Regulator	0.3	0.3	-4.6%	0.4	0.36	-4.6%
Zoo Regulator	0.1	0.1	-4.4%	0.2	0.18	4.4%
Highland 1 Subtotal	*36.6*	*39.1*	*7.0%*	*50.0*	*54.0*	*8.0%*
Highland 2	9.2	9.5	3.9%	22.2	23.06	3.9%
Allentown	4.8	5.0	4.9%	6.1	6.40	4.9%
Squirrel Hill	2.5	2.8	14.1%	3.1	3.54	14.1%
Highland 2 Subtotal	*16.5*	*17.4*	*5.7%*	*28.0*	*29.8*	*6.3%*
Lanpher	8.2	9.2	12.5%	21.2	21.90	3.3%
Brashear	3.4	3.9	17.2%	4.2	4.92	17.2%
McNaugher/Spring Hill	5.7	6.3	10.5%	7.5	8.28	10.5%
Lanpher Subtotal	*17.2*	*19.4*	*12.8%*	*28.0*	*32.0*	*14.3%*
Total Production	70.2	75.9	8.1%	107.0	116.0	8.4%

Note: Maximum day values are not additive to total because service district maximum day events do not coincide.

Evaluation of Distribution Pumping Capacity

The projected maximum day demands for the service districts were compared to the nominal pumping capacities of the associated pumping stations in order to evaluate the

adequacy of the existing pumping facilities under the projected future demand conditions. The nominal pump station capacity represents the sum of the rated capacities with one of the largest pumps out of service. This comparison is summarized in Table 3-15.

Table 3-15
Comparison of Future Demands to Existing Pumping Capacity

Service District	Pump Station	Year 2051 Max Day Demand (mgd)	Pump Station Nominal Capacity (mgd)
Highland 1	n/a	28.01	n/a
Inline Pump District	Inline Pump Station	0.22	0.14
Bedford	Herron Hill Reservoir Pump Station	21.70	24.0
Herron Hill Reservoir			
Herron Hill Tank	Herron Hill Tank Pump Station	0.65	2.0
Bloomfield Regulator	n/a	0.75	n/a
Lincoln	Lincoln Pump Station	2.12	4.0
Garfield	New Highland Pump Station	3.38	4.8
Highland Park/Garfield Regulator	n/a	0.36	n/a
Zoo Regulator	n/a	0.18	n/a
Highland 1 Subtotal	*Bruecken Pump Station*	*54.0*	56.0
Highland 2	n/a	23.06	
Allentown	Mission Pump Station	6.40	26.0
Squirrel Hill	Saline Pump Station	3.54	5.0
Highland 2 Subtotal	*Bruecken Pump Station*	*29.8*	48.0
Lanpher	n/a	21.90	n/a
Brashear	Howard Pump Station	4.92	7.5
McNaugher/Spring Hill	Howard Pump Station	8.28	13.5
Lanpher Subtotal	*Aspinwall Pump Station*	*32.0*	49.0
Nominal Capacity=Rated capacity with largest pump out of service			

As is indicated in Table 3-15, with the exception of the Inline Pump Station, the nominal capacities of the pump stations exceed the projected future maximum day demand, indicating sufficient pumping capacity. The deficiency of the Inline Pump Station was noted under the evaluation under existing demand conditions (Section 3.2). As was stated in Section 3.2, the Inline Pump Station contains two pumps; a 0.14-mgd capacity unit and a 0.29-mgd capacity unit. Consideration should be given to increasing the capacity of the smaller unit to improve system reliability under maximum day demand conditions. It is also noted that the projected maximum day demand approaches, although does not exceed, the nominal pumping capacity of the Herron Hill Reservoir Pump Station and the Bruecken Pump Station Highland 1 set of pumps.

Evaluation of Distribution System Storage Capacity

An evaluation of the adequacy of the distribution system storage capacity was performed under projected year 2051 demand conditions. The basis for evaluating storage capacity under future demand conditions is the same as was used for the existing conditions and was previously discussed in Section 3.2.

Table 3-16 presents a comparison of the computed storage capacity requirements for each of the distribution system storage facilities. As is indicated in Table 3-16, overall the PWSA water distribution system has a surplus of capacity. However, deficits in storage capacities under the future demand conditions are identified for the Herron Hill Tank and the Garfield Tank. The capacity of the Squirrel Hill Tank only marginally satisfies the computed storage requirement and concerns related to the amount and elevations of stored water available in the Squirrel Hill system and the impacts upon system operations and levels of service have existed for some time. In consideration of these factors, there is a need for increasing the storage capacities provided by the Herron Hill Tank and Garfield systems and replacing the Squirrel Hill Tank. A storage deficit is indicated for the Herron Hill Reservoir. However, as is discussed subsequently, it is proposed that a portion of the Herron Hill Reservoir District be moved into the Lincoln District. This would reduce the demands in the Herron Hill Reservoir District, thereby reducing the required storage capacity of the reservoir.

Table 3-16
Evaluation of Distribution System Storage Capacity

	Existing Storage (Mgal)	Required Storage (Mgal)	Surplus/Deficit (Mgal)
Highland 1 Reservoir *	130.5	Included in subtotal	
Bedford Tank	2.1	1.8	0.3
Herron Hill Reservoir	14.0	16.7	-2.7
Herron Hill Tank	0.4	1.3	-0.9
Lincoln Tank	3.0	1.8	1.2
Garfield Tanks	2.0	2.9	-0.9
Highland 1 Reservoir Subtotal	152.0	39.1	112.9
Highland 2 Reservoir	125.0	Included in subtotal	
Allentown Tanks	6.0	5.0	1.0
Squirrel Hill Tank	3.0	2.8	0.2
Highland 2 Reservoir Subtotal	134.0	17.4	116.6

Table 3-16
Evaluation of Distribution System Storage Capacity (continued)

	Existing Storage (Mgal)	Required Storage (Mgal)	Surplus/Deficit (Mgal)
Lanpher Reservoir	133.0	Included in subtotal	
Brashear Tanks	11.0	3.9	7.1
McNaugher/Spring Hill Tanks	6.4	6.3	0.1
Lanpher Reservoir Subtotal	150.4	19.4	131.0
Note: Water stored in the Highland 1 Reservoir cannot be used unless the Membrane Filter Plant is operational and can only be used at a rate within the treatment capacity of the MFP.			

Assessment of Overall Distribution System Performance Under Future Conditions

The PWSA water distribution system model was used to evaluate system performance under future conditions. This analysis was completed by simulating system operation under the projected year 2051 average day and maximum day demand conditions. In order to accomplish this, the existing PWSA water distribution system model was modified to reflect the projected demand rates. The average day and maximum day model simulations were performed and the results of the modeling were reviewed in order to evaluate system performance.

General system performance was evaluated based upon the ability of the distribution system to maintain operating pressures in the distribution grid at or above 35-psi under the average day demand conditions and above 20-psi under the extreme maximum day demand conditions. The results of this evaluation are illustrated in Figures 3-6 and 3-7. Figure 3-6 and Figure 3-7 present the results for the average day and maximum demand conditions, respectively. Because the projected increases in future demands are relatively modest and dispersed throughout the system, there is not a significant difference between current and future system performance. However, existing issues of concern will worsen if remedial actions are not taken. The system improvements identified under the discussion of the existing system under the Task 3.2 section of this report will designed to be effective under future demand conditions.

Assessment of Fire Flow Delivery Capacity

The fire flow capacity of the water distribution system under future demand conditions was evaluated using the computer model. Figure 3-8 presents the computed hydrant flow capacities under future conditions. These results are essentially that same as under existing demand conditions. The remedial measures discussed in Section 3.2 and Section 4.1 will be effective in improving fire flow delivery capabilities.

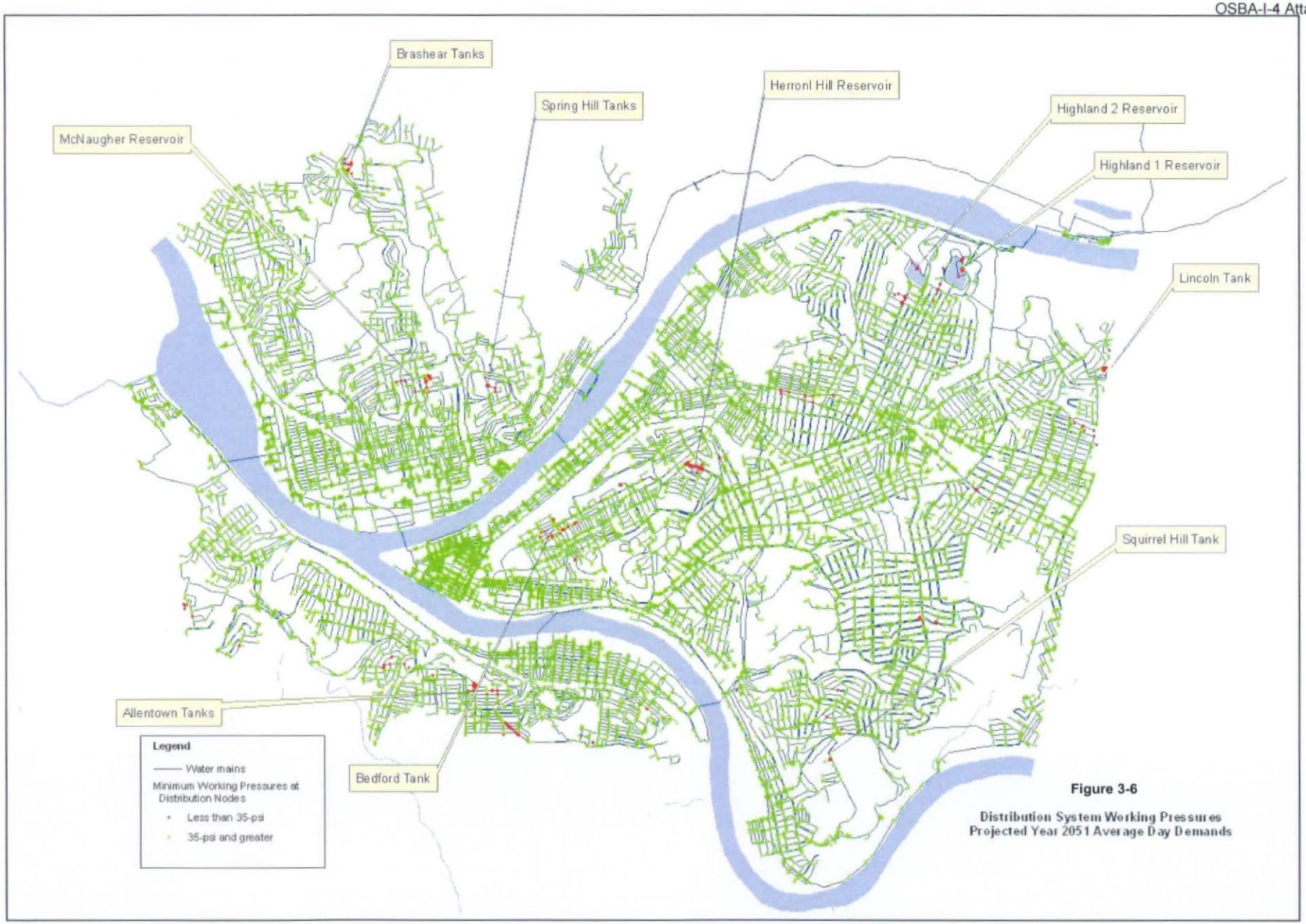


Figure 3-6

Distribution System Working Pressures
Projected Year 2051 Average Day Demands

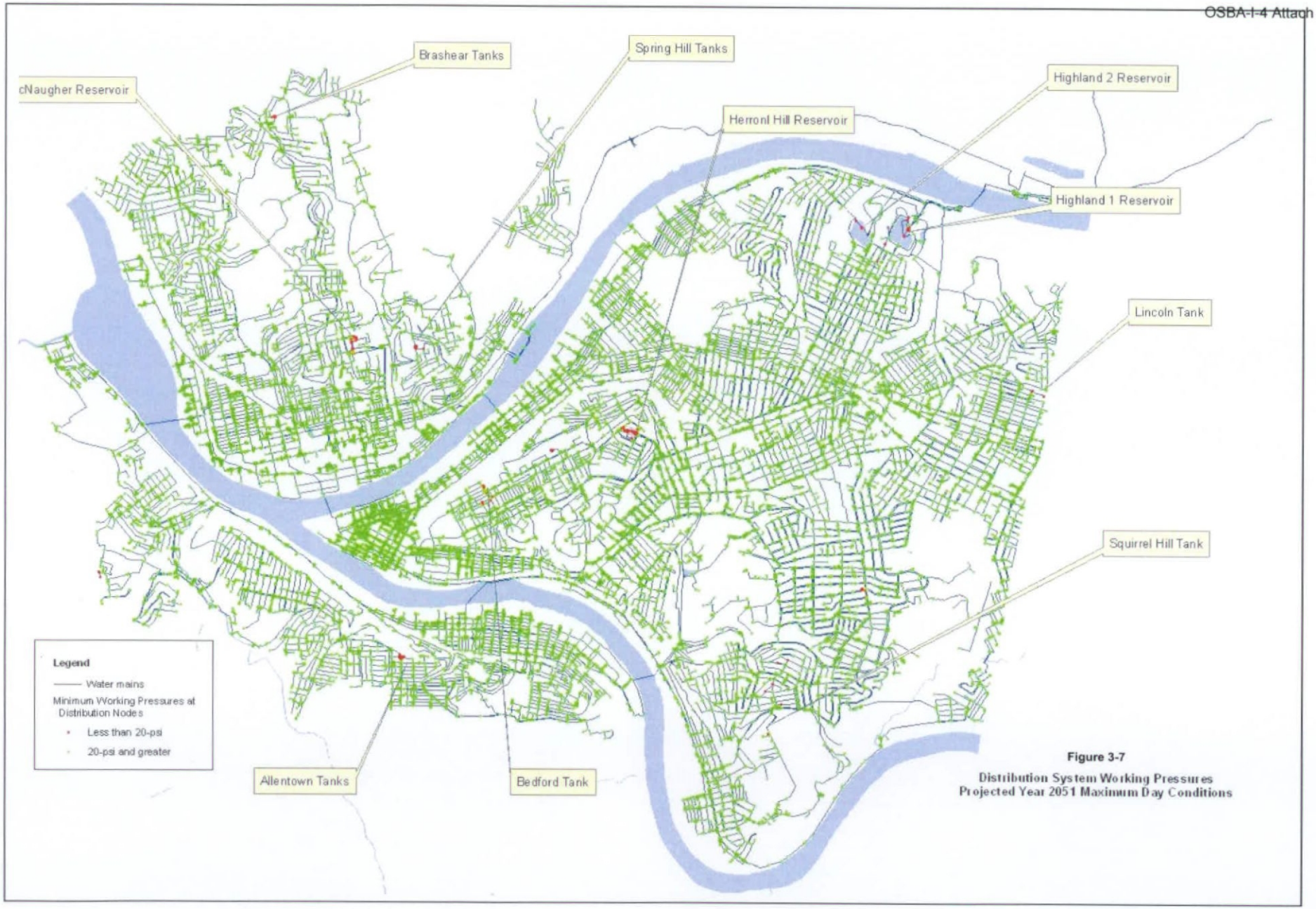


Figure 3-7

Distribution System Working Pressures
Projected Year 2051 Maximum Day Conditions

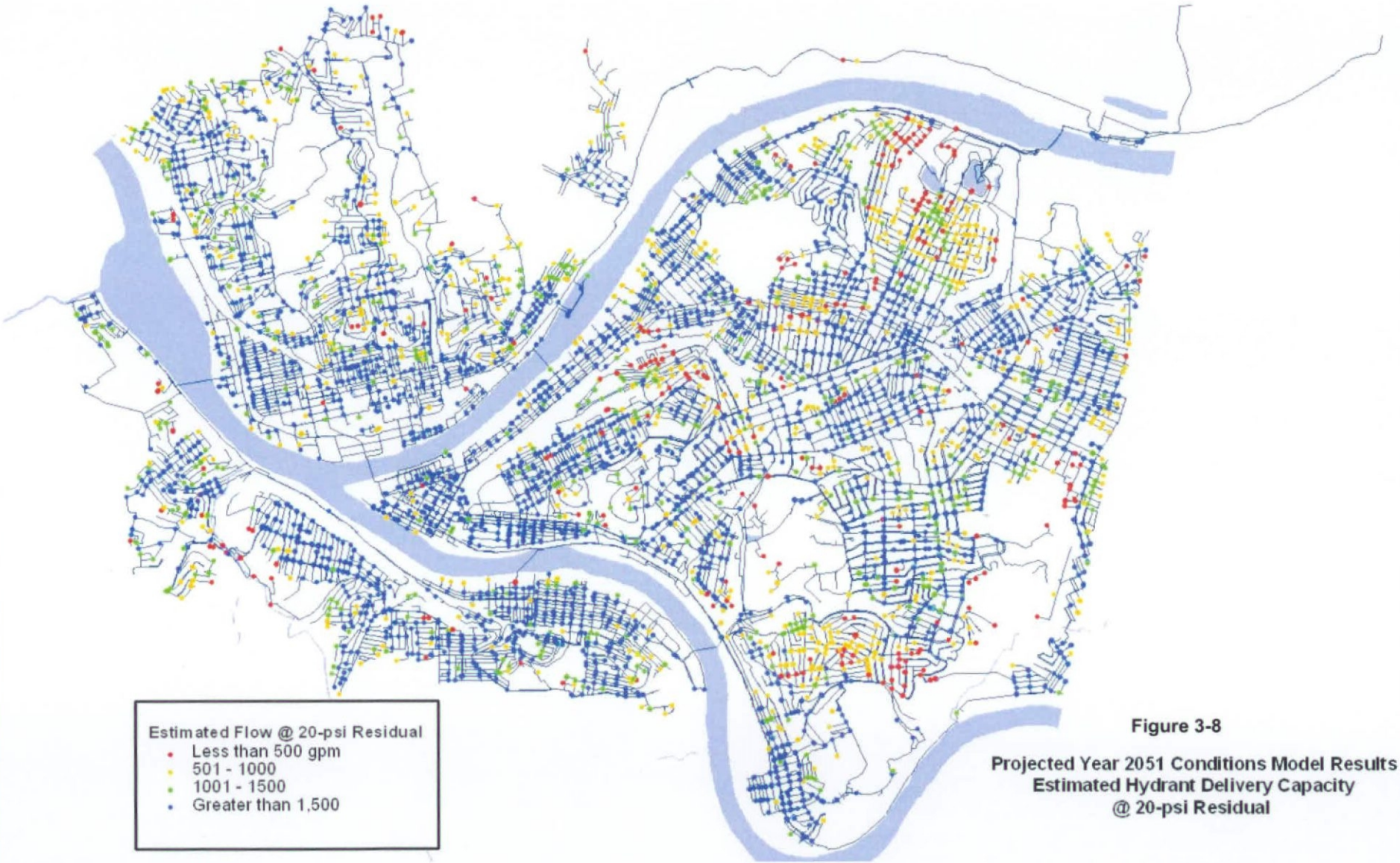


Figure 3-8

Projected Year 2051 Conditions Model Results
Estimated Hydrant Delivery Capacity
@ 20-psi Residual

Improving System Operability/Reliability

Other sections of this report address improvements/updates to the mechanical, electrical and instrumentation systems at the water distribution system pumping facilities. These improvements/updates will improve system operability and reliability. The addition of system storage in the Garfield, Herron Hill Tank, and Squirrel Hill Districts will also improve system reliability. The expansion of the Lincoln District into a portion of the Herron Hill Reservoir District will reduce the load placed upon the Herron Hill Reservoir District and provide a possible emergency service connection to the Squirrel Hill District, both of which will improve system reliability.

An additional improvement that is proposed to significantly improve system reliability is a pump station to transfer water from the Highland 2 Reservoir to the Highland 1 District. The Highland 1 District is supplied by the Bruecken Pump Station and any water that passes through Highland Reservoir 1 must be processed by the Membrane Filtration Plant. Both of these facilities can be affected by power outages and mechanical failures. The proposed transfer pump station will provide the ability to supplement the supply of water into the Highland 1 District in the event that the normal supplies of water to the Highland 1 District are reduced or curtailed. These facilities are described in Section 4.

Addressing the Aging Piping Infrastructure

An on-going water main replacement/rehabilitation program is recommended to address the issue of aging pipes. A risk-based water main repair/replacement capital improvements program has been developed as the basis for prioritizing specific water main replacements in consideration of the likelihood of main failure and the consequences should a failure occur. This program is described in Section 4.

Summary

The following major performance based capital expenditure needs associated with the PWSA water distribution system have been identified:

- Increase the capacity of the Inline Pump Station to provide a nominal firm pumping capacity at least equal to the projected future demand to improve system reliability under maximum day demand conditions.
- Provide at least 2.9 million gallons of storage in the Garfield District.
- Provide at least 1.3 million gallons of storage in the Herron Hill Tank District.
- Replace the Squirrel Hill Tank with two elevated tanks sized to provide at least 2.8 million gallons of storage (1.40 million gallons per tank).
- Supply the higher elevation areas in Millvale that currently experience water pressure problems through a connection with the Reserve Township system.

Another option would be to add an in-line pump station to pump water directly from the 60-inch supply line without the need to flow through Reserve Township.

- Expand the Bloomfield Regulator District in order to increase service pressures in this area in the Penn Avenue/Friendship Avenue/Harriet Street area in Bloomfield.
- Expand the Lincoln Service District into a portion of the Herron Hill Reservoir District to reduce demands on the Herron Hill Reservoir system, improve working pressures in some of the higher elevation areas currently in the Herron Hill Reservoir District and create an emergency secondary feed to the Squirrel Hill District.
- Construct a pump station to transfer water from the Highland 2 Reservoir to the Highland 1 System to increase the reliability of supply to the Highland 1 District.
- Implement an on-going, long range water main replacement/rehabilitation program to address the general issues associated with aging facilities and improve system fire flow capacities.

3.5 SEWER SYSTEM NEEDS

Combined Sewer Overflows (CSOs)

The PWSA Feasibility Study provides preliminary recommendations relative to projects needed to control CSO discharges from PWSA facilities. The October 2008 document is in draft form but still provides the best available indication of the CSO related improvements that will be required by the 2026 Consent Order and Agreement (COA) deadline.

The recommended plan was selected based on a multiple step process. The process included screening technologies to arrive at a short list of applicable CSO controls, prioritizing evaluation factors, generating model results, selecting the CSO control levels to be evaluated, and developing estimated costs for alternative control technologies. A system-wide evaluation was used to identify a highest rated set of improvements, which is based on the 1994 United States Environmental Protection Agency CSO Policy presumptive remedy approach. Under the presumptive approach, compliance with water quality standards is presumed if one of several performance criteria is met. CSO control alternatives in the Feasibility Study were sized for several control levels, including allowing only four overflows per year. Basin planning efforts by ALCOSAN are expected to clarify the ultimate control levels that are needed to meet water quality standards.

The highest ranked alternative for each of the five subsystems evaluated generally includes the conveyance of flows from the PWSA system to the existing points of connection to the ALCOSAN system. The method for managing the flows once they reach the ALCOSAN system is ALCOSAN's responsibility and will be determined by ALCOSAN during its CSO Feasibility Study. In some locations within the PWSA system, it is currently anticipated that flows will be controlled by sewer separation or subsurface storage. Work will also include improvements to CSO outfalls that are jointly permitted to both ALCOSAN and PWSA. It is important to note that ALCOSAN will be responsible for improvements to the jointly permitted outfalls. PWSA customers will share in the costs for improvements to the jointly permitted outfalls through payment of ALCOSAN sewer charges but PWSA will only have to finance capital costs for improvements related to its own CSO outfalls.

Chester Engineers worked with PWSA staff to identify and refine the improvements needed to control overflows from the CSO outfalls that are permitted to PWSA only. The identified improvements are sized to limit CSO discharge to four or fewer times during a typical year and, where necessary, provide sewers that are adequate to convey the peak flow from a 2-year design storm event to the ALCOSAN interceptor system. In cases where improvements are needed to sewers that receive flows from upstream communities, costs for the improvements will be shared between PWSA and the upstream communities. This subject is discussed in greater detail under Task 4.8.

Manhole surcharging and flooding that occur at locations within the PWSA system under extreme conditions are not addressed to any significant extent in the Draft Feasibility Study. This issue is discussed under Task 4.9.

Sewage Pumping Stations

The need for improvements to the four sewage pumping stations owned by PWSA has to be considered during the capital planning process. The Evergreen Road Pump Station is located in the Summer Hill section of the City near the border with Ross Township. The Browns Hill Road Pump Station is situated near the Homestead Grays Bridge in Hazelwood. Both the Rodgers Street and Mifflin Road Pump Stations are located in Lincoln Place, adjacent to the Borough of West Mifflin.

Available information indicates that the sewage pump stations last underwent significant upgrades in the mid-1980's. December 2010 evaluations of the facilities indicate that all the stations are in need of general rehabilitation and upgrades. The sewage and priming pumps at all stations are in good working condition but the priming systems that are needed to accommodate suction lift pumping conditions at the stations require a high degree of maintenance. Replacement of the existing pumps with dry pit submersible grinder-type pumps is currently being evaluated at the four pump stations. Also, the need for installation of emergency backup power generation systems is being reviewed.

Sewage generated in the Lincoln Place portion of the City is currently pumped into the ALCOSAN conveyance system by the Rodgers Street and Mifflin Road sewage pump stations. The area served by these two pump station includes approximately 900 residences. The natural topography of the area would allow gravity conveyance to the sewer system owned by the West Mifflin Sanitary Sewer Municipal Authority (WMSSMA). Transfer of the Lincoln Place service area to WMSSMA via a gravity sewer extension would allow the Rodgers Street and Mifflin Road pump stations to be abandoned, which would save PWSA the cost of upgrading the stations. PWSA and WMSSMA have discussed this situation and have reportedly agreed on terms for a transfer. Since ALCOSAN approval is needed for the transfer to go forward, the 40-Year Plan will include costs for upgrading all four of the PWSA sewage pump stations. However, it is recommended that PWSA pursue transfer of the Lincoln Place service area.

3.6 GREEN TECHNOLOGY ELEMENTS

This section reviews and evaluates green technology elements that could contribute to reduction of CSO problems if implemented in the PWSA service area. Methodologies discussed include installation of plumbing fixtures to reduce wastewater generation rates and green technology-based stormwater controls.

Interior Plumbing Fittings and Fixtures Replacement

Wastewater flows in a combined sewer system might be affected by reducing the amount of sanitary wastewater discharged into the collection system, or by reducing the amount of rainwater that reaches the collection system. Predicting the amount of reduction in wastewater flow by either of these measures will entail a significant degree of uncertainty. The following analysis will offer a broad comparison of the two approaches, as well as information that will offer a general view of potential implementation costs.

The federal Energy Policy Act of 1992 (EPAct 1992) included the following standards for water use by toilets, urinals, faucets, and showerheads:

- Toilets 1.6 gallons per flush (gpf)
- Urinals 1.0 gpf
- Faucets 2.5 gallons per minute (gpm)
- Showerheads 2.5 gpm

Prior to EPAct 1992 limits, which became effective in 1994, toilets flushing at the rate of five gallons or more were not uncommon. In the time since these limits were first promulgated, potable water purveyors in many parts of the U.S. organized programs to replace older sanitary fixtures, particularly toilets, in order to conserve water. These

conservation programs resulted in decreased wastewater flows as well as potable water use reduction.

A typical household with pre-1994 interior plumbing fixtures were predicted to use about 69.3 gallons per capita per day (gpcd), according to data derived from the American Water Works Association Research Foundation's *Residential End Uses of Water* (Vickers 2001). Post-1994 households were predicted to use 45.2 gpcd. These estimates of total residential water use were broken down as shown below:

Water use	Pre-1994 gpcd	Post-1994 gpcd
Toilets	18.5	8.2
Showers	11.6	8.8
Faucets	10.9	10.8
Other uses	28.3	17.4
Total use	69.3	45.2

'Other uses' includes clothes washers and dishwashers, as well as leaks.

These estimates imply that a residence that was built before 1994 and has not been remodeled might present the opportunity to decrease wastewater flow by 10.3 gpcd from toilets and by 2.8 gpcd from showerheads. Faucet use does not appear to offer appreciable opportunity for decreasing wastewater flow and achieving flow reductions from 'other uses' would entail extensive and expensive programs to replace clothes washers and dishwashers.

Data compiled by the US Census indicates that 95 percent of occupied housing units in the City of Pittsburgh were constructed prior to 1990. This proportion offers a reasonable estimate of pre-1994 housing units. Post-1994 housing stock probably constitutes a larger proportion of total units outside the city limits. Census data do not indicate whether bathroom upgrades were made to houses within the PWSA wastewater service area. Regardless of the uncertainty entailed in the data, it is instructive to consider housing units within the city limits as not having been upgraded since their original construction, and to calculate the potential wastewater flow reduction that would result from retrofitting all of those housing units with post-1994 toilets and showerheads. The result of this analysis might be considered an upper estimate for the possible extent of wastewater flow reduction that might be achieved by a comprehensive program of residential toilet and showerhead upgrades in the PWSA sewer service area is:

> City of Pittsburgh 2010 Census population (305,700) x (30.1 – 17.0) gpcd = 4 million gallons per day (mgd).

If half of the residential units in the combined sewer service area have been upgraded to post-1994 sanitary fixtures, the reduction of daily wastewater volume that might be achieved by upgrading the remaining residential units would be about 2 mgd. For the

purposes of this analysis, two toilets and one showerhead per dwelling unit are assumed to be upgraded in each residential unit. Such a program would entail 260,000 toilets and 130,000 showerheads if all of the pre-1994 residential units within the City of Pittsburgh were to be upgraded, or 130,000 toilets and 65,000 showerheads if half of the pre-1994 residential units were to be upgraded.

Water use for EPAct 1992 fittings and fixtures in commercial, institutional, and industrial (CII) sector is very difficult to estimate. CII establishments vary widely in occupancy, functions, and schedule. A very rough approximation of water use in toilets might be derived by comparing per capita residential use to workday use in CII establishments. The post-1994 per capita daily use of 8.2 gallons implies about five uses by each resident (8.2 divided by 1.6 gpf). Workplace use of toilets would likely average less than five times daily. Three uses per day by each workplace occupant would seem to be a plausible estimate. Distinguishing between toilet and urinal use would not be practical at this planning level. These assumptions lead to an estimated wastewater flow reduction of 6.2 gallons per day per CII occupant.

8.2 gpcd x 3/5 = 6.2 gallons per day per CII occupant

Potential wastewater flow reduction in the CII sector might be estimated by considering only toilets. Differentiating between toilets and urinals would not enhance a model at this planning level, and showerhead use cannot be defined without detailed building occupant data. Deriving this information would not be cost-effective, considering the scale of other unknowns and assumptions.

The 2000 Census provided an estimate of about 472,800 daytime occupants in City of Pittsburgh workplaces. Although an estimate of the number of workplaces with pre-1994 toilets is not available, assuming that all of the workplaces within the City are equipped with pre-1994 fixtures might provide a reasonable estimate of the maximum potential effect of a program to upgrade old toilets in the CII sector.

City of Pittsburgh workplace population (472,800) x (18.5 – 8.2) x 3/5 = 2.9 mgd

The number of toilets that would need to be replaced to achieve this level of wastewater flow reduction might be estimated by assuming workplaces conform to typical requirements of current plumbing codes, which call for between one toilet per 10 occupants to one toilet per 500 occupants, depending on building use. One toilet per 100 occupants seems to be a reasonable assumption to derive a general idea of the number of fixtures that a comprehensive fixture upgrade program might entail.

This analysis can be summarized as follows:

- Residential fitting and fixture upgrade program
  - Higher estimate
    - 260,000 toilets

    - 130,000 showerheads
  - Lower estimate
    - 130,000 toilets
    - 65,000 showerheads
- CII fixture upgrade program
  - 4700 toilets

Program costs to replace these fittings and fixtures might be estimated as:

- Residential toilets and showerheads– higher estimate
  - (260,000 x $200) + (130,000 x $20) = $57 million
  - Cost per mgd decrease, residential higher estimate - about $14 million
- Residential toilets and showerheads – Lower estimate
  - (130,000 x $200) + (65,000 x $20) = $27 million
  - Cost per mgd decrease, residential lower estimate - about $14 million
- CII toilets upgrades, represented by toilets
  - 4700 x $200 = $1 million
  - Cost per mgd decrease, CII – about $300,000 per mgd

Although there is a great deal of uncertainty in these estimates, it seems likely that the cost per unit wastewater flow reduction in the CII sector would be at least an order of magnitude less than the unit cost in the residential sector. Of course, the value of potable water saved by retrofitting interior residential fittings and fixtures might make such a program more attractive when combined with wastewater flow reduction.

Fittings and Fixture Replacement Programs

These programs have generally been focused on decreasing potable water demand; only a few reports offer observations regarding wastewater flow reduction. Many of the water use reduction programs involved rebates for customer purchase of efficient sanitary fixtures. Some of these rebates were reported to have covered the entire cost of fixture replacement, others probably defrayed only a portion of the cost to the water customer. The costs per mgd wastewater flow reduction reported or derived below should be considered in light of these uncertainties.

New York City NY

The New York City Department of Environmental Protection (NYC DEP) launched what the department calls the world's largest toilet rebate program in

1994. Between 1994 and 1997 NYC DEP provided rebates to building owners for replacement of 1.3 million toilets. The program estimated 90 mgd reduction in potable water usage for this program. During this period, total potable water consumption in New York City was about 1300 mgd. Program costs were reported to be $150 to $240 per toilet replaced. If wastewater flow reduction is assumed to correspond to potable water use reduction on a gallon-to-gallon basis, the cost per mgd decrease in wastewater flow achieved by the New York City program would be estimated as about $3 million.

NYC DEP is developing plans to offer a limited voucher-based plan for additional toilet replacements for 2014 and 2015.

Ashland OR

This municipality of about 20,000 population initiated a water conservation program in 1991 that included leak detection and repair, conservation-based water rates, showerhead replacement, and toilet replacement. The program was credited with a reduction of 16 percent of daily water usage and an estimated 58 million gallons per year of wastewater flow (160,000 gallons per day). The conservation program was estimated to cost about $800,000. Based on these figures, the cost per mgd reduction for the Ashland program was about $5 million. Ashland is now offering rebates of $45 to property owners who replace 1.6 gpf toilets with ultra-low flow toilets (1.28 gpf).

Goleta CA

The Goleta Water District carried out a water conservation program that focused on high-efficiency toilets and low-flow showerheads between 1987 and 1991, several years prior to promulgation of fitting and fixture standards under EPAct 1992. Combined with a water rationing program and changes to the water rate structure, the program resulted in a decrease in per capita water use from 125 to 90 gpcd. The water conservation program was also credited with a decrease in wastewater flow from 6.7 mgd to 4 mgd. The program was reported to have cost $1.5 million. The cost per mgd reduction was about $600,000.

Houston TX

This large system purveys potable water to a population of 1.7 million, as well as 553,000 CII customers. The Houston conservation program included changing water rates to an increasing block structure, and an extensive public education program. A pilot program carried out in cooperation with the housing authority to replace pre-1994 toilets with 1.6 gpf fixtures indicated that water savings and wastewater flow reduction could quickly offset the cost of installing the new

fixtures. The Houston department of Public Works and Engineering projected a benefit to cost ratio of more than 3 to 1 for expansion of the conservation program.

Massachusetts Water Resources Authority

MWRA is the wholesale water provider for 2.2 million people in 46 cities, towns, and water districts in the Boston area. The authority embarked on a ten-year program to decrease water demand in 1987, responding to predictions that population growth would result in overdrawing the safe yield of water sources. The program included changes to water rate structures, aggressive leak detection and repair, and retrofitting 370,000 homes to reduce potable water use by showerheads, faucets, and toilets. Retrofitting was done by MWRA crews, which replaced showerheads, installed restricting faucet aerators, and installed toilet dams in the tanks of existing toilets. The efforts resulted in reduction of average daily demand from 336 mgd in 1987 to 256 mgd in 1997. MWRA estimated that the 1990 cost per mgd water demand reduction was about $1.8 million.

Santa Monica CA

The Metropolitan Water District of Southern California initiated a program to reduce water use by 20 percent and wastewater flow by 15 percent between 1990 and 2000. The program had many elements, including changes to water rates, technical assistance, particularly for outdoor water conservation, rebates for toilet retrofits, and enhanced enforcement authority. Under the toilet rebate program, 41,000 residential fixtures and 1600 fixtures in private CII buildings were replaced, along with 1200 toilets in city-owned buildings. Potable water usage was reported to have decreased by 2 mgd and wastewater flow reduction was reported to be 2.2 mgd. The toilet rebate program offered $75 per fixture replaced, an amount that would not cover the full cost of a retrofit. Based on an estimated $200 cost to replace a toilet, the cost per mgd of wastewater reduced would be estimated to be about $4 million.

Seattle WA

Seattle Public Utilities (SPU) provides potable water to about 1.3 million people in Seattle and surrounding municipalities. SPU also collects wastewater within the City of Seattle, for treatment at one of several wastewater treatment plants operated by King County. The agency has two programs: one for residential customers (Home Water Savers Program) and one for CII customers (Water Smart Technology). Established in 1990, the programs have emphasized replacement of indoor fittings and fixtures, block rate structure for peak water use

periods, and water leak detection and repair. The program has been cited by many sources as exemplary, and it continues in effect today.

SPU has reported on the results of a toilet replacement program aimed at the CII sector, citing 0.8 mgd water usage reduction brought about by 600 businesses replacing 10,000 toilets. If this reduction of water usage resulted in an equal amount of wastewater flow reduction, the cost per mgd would be estimated at about $2.5 million.

Barrie ON (Canada)

This city near Toronto developed a fixture replacement program to decrease wastewater flows, in order to defer expansion of the community's wastewater treatment plant. Between 1995 and 1997, 10,500 households replaced 15,000 toilets with 1.6-gpf units, and a similar number of showerheads, receiving rebates of $145 (Canadian Dollars) for toilets and $8 for showerheads. Flow analysis indicated that water use in participating households was reduced by 16.4 gpcd, and that flow to the wastewater treatment plant was reduced by about 0.35 mgd. Cost per mgd wastewater flow reduced for this program would be about $9 million, based on $200 for toilet replacement and $20 for showerhead replacement.

Summary Observations

1. A residential toilet replacement program would be a great deal more costly than a CII program, on a cost per mgd of wastewater flow reduction basis.
2. A CII toilet replacement program might cost about $1 million per mgd reduction of wastewater flow.
3. A CII program in the PWSA service area might result in one or two mgd wastewater flow reduction.

Green Stormwater Infrastructure

In the combined sewer portions of the PWSA system, wastewater flow rate and volume may be decreased by diverting stormwater runoff from the sewer system. Wastewater flow rate may be decreased by delaying runoff as it travels toward the sewer system. Green stormwater infrastructure (GSI) may offer a cost-effective alternative to traditional wet weather storage facilities constructed in the wastewater collection system.

The GSI concept distributes stormwater runoff diversion or delaying facilities throughout the sewer service area, to deal with runoff as 'early' as possible. This approach avoids concentrating flows, allowing relatively small facilities to contribute significantly in

aggregate to controlling stormwater runoff entry into the sewer system. In an urban setting, GSI facilities may be constructed on roof tops, at the roof drain discharge, or in paved areas.

Rooftop GSI

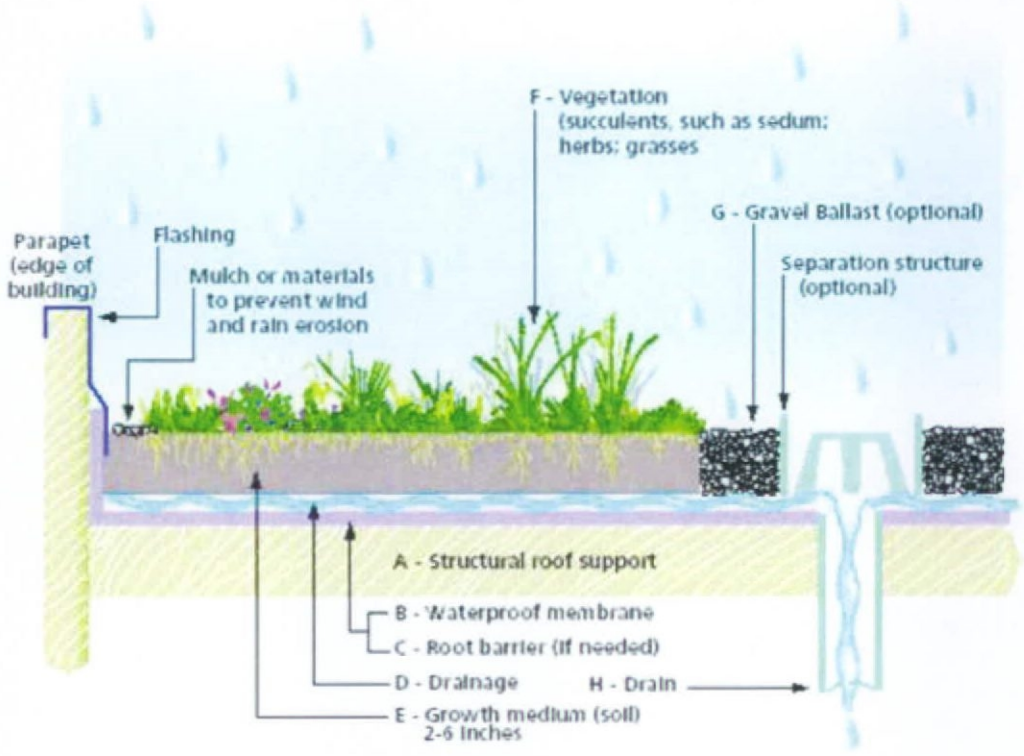
A vegetated roof can be designed to hold a portion of the rainfall that falls on the roof. Some of the rainfall will be diverted: held by the growth media and transpired by the vegetation. The amount of rainfall thus diverted will depend on a number of factors, such as the depth of the media and the type of vegetation planted on the roof. In general, vegetated roofs are classified as 'extensive' or 'intensive'. Vegetated roofs consist of several layers, starting at the bottom:

- Waterproof membrane installed over the roof structure
- Drainage layer that will collect and convey rainwater that infiltrates through the growth media
- Filter fabric to separate the drainage layer from the growth media, thus preventing downward migration of media particles and clogging of the drainage layer
- Growth media, generally consisting of light weight granular material
- Plant materials

Vegetated roofs can be installed in place, layer-by-layer, or they may be installed as modules that incorporate all of the layers, including vegetation.



Source: Low Impact Development Center



Source: City of Sandy OR

An extensive vegetated roof consists of a relatively shallow layer (3 or 4 inches) of growth media placed on a drainage layer, above a waterproof roof membrane. Typical vegetation used on an extensive vegetated roof is drought-resistant species such as sedum. These roofs are typically not irrigated. An intensive vegetated roof would typically have greater depth of growth media (from 4 inches to more than a foot) over the drainage layer. These roofs may be planted with a wider variety of vegetation, including small trees, and irrigation is generally required. Intensive roofs are often intended for use by building occupants; extensive roofs are generally not intended for use by occupants.

The vegetated roof may decrease rainfall runoff volume by absorbing a portion of the rainfall in the growth media. This retention reduces the rate of runoff from the roof to essentially zero until the media become saturated. As the media are saturated by rainfall, the roof begins to drain at about the rate of continuing rainfall. Water held in the media is released to the atmosphere through evapotranspiration after the rainfall event ends.

Research performed at Penn State University and Michigan State University indicates that media depth between 3 and 4 inches is optimal for holding rainfall. Deeper media were not observed to increase the volume retained. Other research findings included:

- Vegetated roofs retained about half of the annual rainfall volume. This finding is probably strongly related to the location of the research. The precipitation patterns in both locations are similar enough to Pittsburgh to adopt this general finding for this preliminary stage evaluation.
- Runoff from the roofs was delayed until growth media were saturated. Following saturation, runoff occurred at about the same rate as rainfall.
- High-intensity, short duration rainfall was attenuated more than lower intensity, longer duration rainfall.
- Roof slope had a small effect on runoff. More steeply sloped roofs produced slightly higher runoff volumes and rates, compared to less steeply sloped roofs.

It should be noted that the roof slopes studied by both Penn State and Michigan State were relatively shallow: between 2 percent and about 8 percent. Vegetated roofs have been installed on roofs as steep as 33 percent, but a slope of 25 percent is often cited as a practical maximum for vegetated roofs. The Penn State research indicated that nearly 95 percent of precipitation from summer rainfall events was retained by the vegetated roofs.

Based on these research findings, it appears extensive vegetated roofs would offer the more cost-effective approach to rooftop GSI control of wet weather flows to a combined sewer system, rather than intensive roofs. Extensive roofs are less costly to construct, since they require smaller volumes of media and impose less weight on the roof structure. Extensive roofs are also designed to function without irrigation, leading to lower operation and maintenance costs.

The potential effectiveness of rooftop GSI may be projected by considering the volume of rainfall that would be retained by a unit area of vegetated roof. Over the course of a year in Pittsburgh, where average annual precipitation is about 38 inches, a square foot of vegetated roof might be expected to retain half of the 24 gallons of rainfall it receives. During the summer months of June, July, and August, a square foot of vegetated roof might be expected to retain about 6 gallons of rainfall (95% of the 10.8 inches of rainfall striking the roof).

Residential Vegetated Roofs

The residential sector in the combined sewer area consists of many relatively small roofs, some flat and others sloped. If 800 square feet is considered as a typical residence footprint in the combined sewer service area, each vegetated roof might be expected to retain 9600 gallons of rainfall runoff in an average year and 4800 gallons of runoff during an average summer. Each residential installation would have to be preceded by a structural inspection to confirm that the existing roof would be able to support the additional load of an extensive

vegetated roof. If a residential roof were determined to be unable to support the additional load, it would logically be removed from consideration, as structural modifications to allow for the vegetated roof installation would almost certainly prove to be not cost-effective.

The installation cost of vegetated roofs has been estimated to be between $10 and $25 per square foot, with the higher side of the range relating to intensive roofs. Modular vegetated roof systems, which would probably be most plausible for residential use, are estimated to cost about $15 per square foot. The direct costs involved to install a vegetated roof on a typical 800-square foot residence might be:

- Structural assessment $ 1,000
- Roof installation $12,000
- Total cost $13,000

The cost per unit of runoff retained would thus be about $1.40 per gallon of annual runoff retained.

In addition to these direct costs, a public agency sponsoring a vegetated roof program for stormwater runoff control would have to consider administrative costs. Such costs would be fairly high on a unit runoff removed basis, due to the relatively small amount of flow attenuation that could be realized from each residence.

Commercial / Industrial / Institutional (CII) Vegetated Roofs

The CII sector will offer roofs that are generally much larger than residential roofs for GSI installations. The number of roofs in the combined sewer service area, and their typical size, are not known. A few assumptions can be made to estimate a cost per unit of runoff retained from CII buildings:

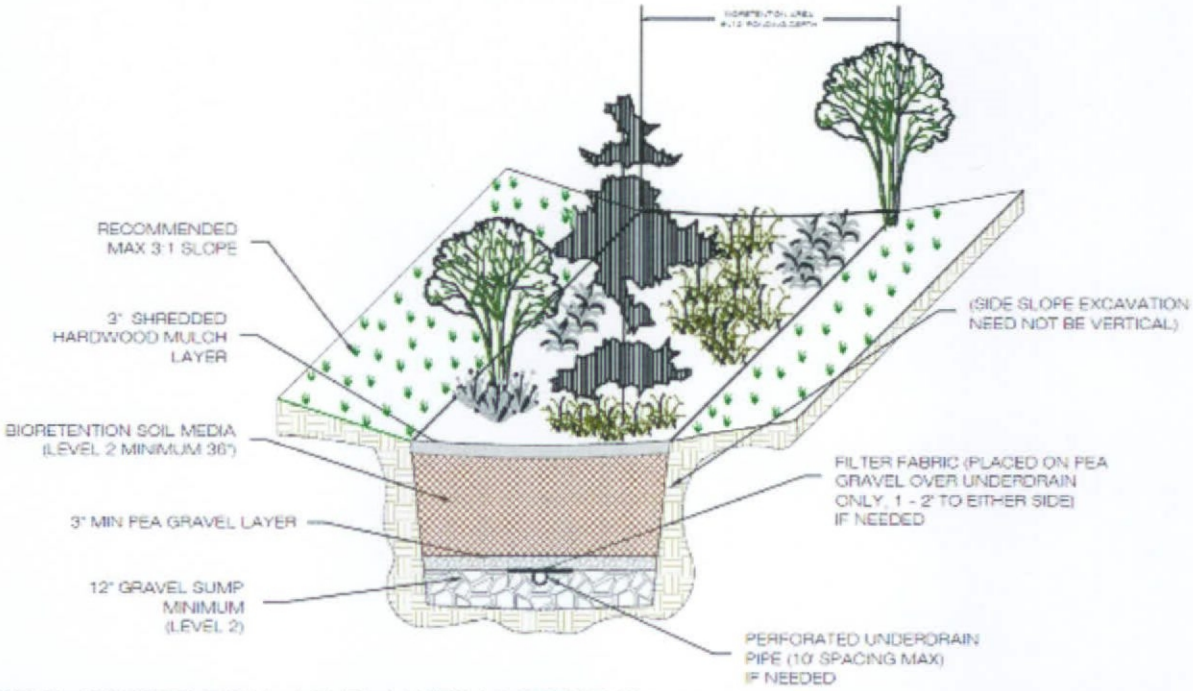
- Extensive CII vegetated roof would have a lower unit cost than residential roof.
  - Assume unit cost of $12 per square foot for roof installation.
- Structural assessment would be more complex, but potential to attenuate rainfall might make strengthening of existing roof structure cost-effective.
  - Assume $2 per square foot for structural evaluation and strengthening.

Using these assumptions, the direct unit cost of runoff retained in extensive vegetated roofs installed on CII buildings in the combined sewer service area might be about $1.20 per gallon of annual runoff retained.

The administrative effort and cost to recruit CII rooftops and manage the program for runoff attenuation would be significantly less than a program in the residential sector.

Roof Drainage GSI

Roof drainage may be intercepted as it reaches the ground, and conveyed to best management practices (BMPs) that might retain or delay the runoff as it travels toward the combined sewer system. A wide variety of BMPs exists, and the particular circumstances of a site will determine which approach would be most feasible. For the purposes of this preliminary analysis, a bioretention facility similar to the sketch below will offer a reasonable estimate of the potential runoff retention that could be achieved by this kind of GSI distributed in the CSO area.



TYPICAL BIORETENTION - LEVEL 2 WITH UNDERDRAIN

NTS

Source: Virginia Department of Conservation and Recreation

Sizing criteria for bioretention facilities range from about 2 percent to 7 percent of tributary area. For this analysis, a 5 percent criterion will be used. Thus, an impervious area of 100 square feet would be served by 5 square feet of bioretention surface area. If bioretention designed to this size criterion would

retain all of the rainwater it receives, a square foot of such a facility constructed in the PWSA combined sewer service area might be able to reduce stormwater runoff flow volume to the combined sewers by as much as 470 gallons annually.

In the residential sector, the typical 800 square foot roof envisioned for the vegetated roof analysis would require about 40 square feet of bioretention area at the ground surface. Bioretention designed according to this criterion will be considered to retain all of the runoff from the roof surface that it serves.

The cost of bioretention facilities has been reported from $5 per square foot to $40 per square foot, with the lower end of the range pertaining to simple residential installations and the higher end to complex CII facilities. For the purposes of this analysis, $20 per square foot of bioretention surface will be used to planning level cost comparisons. At this unit cost, diversion of a gallon of stormwater from the combined sewers might be accomplished for about $0.04.

This analysis illustrates the large difference in unit cost to retain or delay stormwater runoff between rooftop and ground level GSI practices.

Paved Areas GSI

Rainwater runoff from ground surface impervious areas, such as parking lots, streets, and other urban hardscape, could be retained by bioretention facilities in the same manner as rooftop runoff. Bioretention could be installed at the edges and within parking lots and other large paved areas, to intercept runoff and either retain or delay its entry into the combined sewer system. The concept and unit cost for bioretention control of ground level runoff would be similar to control of roof drainage.

Paved areas may also be modified to provide infiltration and short-term storage of runoff beneath the paved areas. If soils drain sufficiently well, these facilities may result in some retention of runoff, as well as delayed entry of runoff into the combined sewer system. In parking lots, edge spaces might be retrofitted with subsurface storage/infiltration systems and overlain by pervious paving. Infiltration or bioretention beds may also be installed in the interior portions of paved areas, on a 1:20 basis (5 percent of tributary area) to intercept runoff within the paved areas and prevent its reaching storm drains, or to delay its entry into the combined sewer system. This approach would obviously decrease the number of spaces available for parking.

The cost of installing storage/infiltration/bioretention facilities in existing paved areas, such as parking lots, would be higher than the costs cited above for rooftop drainage bioretention. If unit costs were $40 per square foot of storage/infiltration/bioretention facilities, the diversion of a gallon of rainwater runoff from combined sewers might be about $0.08.

GSI can be adapted to many configurations of urban hardscape. For instance, the City of Philadelphia has developed a Tree Trench concept, which is a long, relatively narrow bioretention BMP that collects and retains or delays runoff from contiguous sidewalks. Storage/infiltration/bioretention can be incorporated into many construction activities, with little additional cost incurred.



Source: City of Philadelphia

GSI measures, applied even as small elements, can have a significant positive effect on wet weather flows in combined sewers. Their relatively small size makes them less daunting than large, bottom of basin storage facilities.

GSI Use in Other Cities

A number of wastewater agencies serving large urban areas have incorporated GSI into programs to control wastewater discharges from combined sewer areas.

Philadelphia PA

The Philadelphia Water Department (PWD) updated its Long Term Control Plan to reduce combined sewer overflows (CSOs) in 2007 to consider the potential benefits of GSI to supplement more traditional engineered infrastructure approaches to CSO reduction. Philadelphia entered into a consent order with PA DEP in 2011 that includes the concept of a 'Greened Acre' as a CSO control measure. A Greened Acre is one that is determined to have sufficient GSI measures in place to retain one inch of rainfall, thus diverting about 27,000 gallons of flow from the city's combined sewer system. PWD will test the concept over the next five years by developing and monitoring 744 Greened Acres. If the concept is proven, PWD will proceed to develop a total of nearly 10,000 Greened Acres in place at the end of a 25-year planning horizon.

The current PWD capital program budget illustrates the intended emphasis on GSI. Funding for GSI projects is about five times the projected funding for more traditional wastewater treatment solutions to CSOs in Philadelphia.

Portland OR

Portland entered a Stipulation and Final Order (SFO) in 1991 to reduce CSOs during a twenty year period, and succeeded in meeting the requirements of the agreement in 2011. Green infrastructure was adopted early in the city's response to the SFO through a program known as the Cornerstone Project. As it became evident that the SFO goal would be met, the city considered how continuing development could be allowed without losing some of the progress that had been made. Portland promulgated land development requirements that called for GSI measures and rehabilitation of conventional wastewater infrastructure that would achieve further CSO reductions to accompany land development.

A broadly based project known as Tabor to the River illustrates the comprehensive approach taken by Portland to build on the improvements made under the SFO. The project, which involves 2.3 square miles of the downtown, includes:

- 500 green street facilities, such as vegetated curb extensions and streetside planters,
- Rehabilitation or replacement of 81,000 lineal feet of sewer,
- 4000 street trees, and
- Working with private property owners to construct facilities to manage roof and parking lot runoff.

Portland has also established a 1% For Green Fund, which assesses a fee of one percent of the construction budget of any project in the public right of way that is not subject to stormwater regulations, such as projects smaller than the threshold area defined in the stormwater management manual. Funds are used to support other projects that either exceed the requirements of the stormwater manual or that are not subject to stormwater regulations.

Toronto ON Canada

Interest in vegetated roofs in Toronto was motivated first by concerns for biodiversity. A 2004 study suggested that a considerable portion of the city's footprint would be suitable for greening. A 2005 study identified the potential positive effect of GSI on Toronto's CSO program. The study included modeling of the extent to which GSI could offset conventional wet weather flow storage.

Modeling results suggested that if 5 percent of impervious cover within the 9100-hectare combined sewer area were replaced by GSI facilities, wastewater storage volume could be reduced by about 5 percent. Replacing 15 percent of impervious cover with GSI facilities was projected to allow storage volume to be reduced by about 13 percent.

In 2006 Toronto established a Green Roof Strategy intended to:

- Encourage the installation of vegetated roofs on city-owned buildings,
- Set up a pilot incentive program to encourage private owners to install vegetated roofs,
- Modify the land development review process to encourage vegetated roofs on new or renovated buildings, and
- Provide publicity and education to residents and businesses.

The Green Roof Strategy resulted in three city buildings being retrofitted with vegetated roofs and 7000 square meters of vegetated roof installed under the incentive program. A follow-on program called Eco-Roof was launched in 2009 with fourteen projects and 8100 square meters of vegetated roof.

In 2009, Toronto became the first city in North America to require vegetated roofs for new buildings. Buildings larger than 2000 square meters gross floor area permitted after January 31, 2010 are required to have vegetated cover for between 20 percent and 60 percent of roof area. Building developers may opt out of the requirement for a payment in lieu of $200 per square meter.

Seattle WA

Seattle Public Utilities developed a stormwater code to support the metropolitan area's Phase I NPDES and MS4 permit compliance program. This code establishes stormwater volume and peak rate controls for various types of urban land, including land within the combined sewer area of the City of Seattle. New development or redevelopment projects are required to use GSI to 'the maximum extent possible'. Relatively smaller projects – less than 10,000 square feet of new or replaced impervious surface – the code offers an option to employ 'pre-sized' flow control devices, to relieve smaller projects of the need to perform hydrologic modeling.

San Francisco CA

Stormwater guidelines specifically address control of wet weather flows in the city's combined sewer area. GSI is recognized along with conventional engineered measures to control volume and peak flows. The guidelines invoke

green building rating systems, such as Leadership in Energy and Environmental Design (LEED®) to establish requirements. For instance, in combined sewer areas under jurisdiction of the San Francisco Public Utilities Commission applicants for building permits are required to reduce volume and flow rate of runoff from rain events in accordance with Sustainable Sites Credit 6.1 – Stormwater Design: Quantity Control from the LEED for New Construction rating system.

Chicago IL

The Metropolitan Water Reclamation District of Greater Chicago (MWRD) developed one of the first wet weather storage systems, starting in the 1970s. The Chicago Tunnel and Reservoir Plan (TARP), which will consist of more than 100 miles of deep rock tunnels and 2.3 billion gallons of storage capacity, was the first project of its kind in the U.S. Construction of TARP commenced in the early 1970s and is planned for completion in 2015.

In December 2011 MWRD and U.S. EPA executed a consent decree that established an enforceable schedule for completion of TARP facilities. The consent decree also required a Green Infrastructure program that will entail spending of $25 million to $50 million on facilities that would:

- Reduce basement flooding,
- Readily become permanent stormwater control measures,
- Convert vacant parcels into 'stormwater parks', and
- Improve socio-economic conditions in areas impacted by environmental justice concerns.

The consent order sets goals for MWRD to build GSI stormwater retention capacity and offers such retention capacity to offset conventional storage capacity under certain circumstances, subject to EPA approval. The Green Infrastructure program also requires the distribution of 15,000 rain barrels to residential owners within the first five years, and an incentive program for GSI facilities on land leased by private entities from MWRD.

Summary Observations

Reduction of wastewater volume and flow rate by reducing potable water usage and by reducing rainwater runoff cannot be compared directly. Reduction of water usage constitutes reduction of base flow to the wastewater collection system. The positive effect of such reduction is limited, as removing base flow may simply 'make room' for rainwater runoff to enter the combined sewer system. This factor, along with the extremely high cost to reduce wastewater flow by reducing

water usage, recommend against using water use reduction measures to address the wet weather combined sewer overflow issue.

Small, distributed stormwater runoff storage facilities built with GSI practices in the sewer service area could reduce a portion of the excessive wet weather flows to the combined sewer system. Estimated costs to store a gallon of rainwater runoff are summarized below. It should be noted that some portion - perhaps a significant portion - of the stored runoff volume would not have to be pumped into the sewer system after the wet weather event has passed, as a portion of the stored runoff will infiltrate into the ground. This infiltration volume will, of course, depend on underlying soil characteristics and other site conditions.

1. Rooftop storage of rainwater runoff is estimated to cost between $1.20 and $1.40 per gallon.
2. Ground level storage of roof runoff is estimated to cost about $0.04 per gallon.
3. Storage of runoff from paved areas is estimated to cost about $0.08 per gallon.

3.7 PUMPING AND TREATMENT INVENTORY

An inventory of major PWSA pumps and equipment can be found in Appendix 3-8. The inventory includes pumps and equipment at water pumping stations, the Highland membrane filtration plant, the Aspinwall water treatment plant, and at the four sewage pumping stations. The inventory also lists information about chlorine booster stations that are located at water storage facilities.

The inventory presents information about the pumps and equipment located at each PWSA facility. Information on the list includes equipment name or brief description, equipment manufacturer, model / serial number, capacity, number of units, date installed, age of unit, and general condition based on appearance and input from PWSA staff. The equipment inventory primarily focused on pumps and treatment plant process equipment but also include major electrical components such as motor control centers and emergency generators. The collected information in the Excel spreadsheet was used in Task 4 to facilitate the development of capital budgets.

3.8 ASSET MANAGEMENT VIA GIS SYSTEM

Review of System

The PWSA currently manages its water and sewer infrastructure information on a GIS-based platform using the ESRI ArcGIS suite of software products. Utility GIS data is stored in an ESRI GIS database (Geodatabase) running on SQL Server. This data

management scheme supports a GIS-enabled intranet site which provides users throughout the organization with access to water and sewer mapping via a web-browser interface.

Utility GIS information is also provided to field inspection crews on ruggedized, tablet PCs, which are used to support on-going manhole and inlet inspection programs and other PM activities. The field inspection application works off of a local set of the mapping data stored on each individual tablet. Inspector field notes and edits are transmitted by redlining of comments, which are reviewed by the GIS staff and used to support mapping edits.

The PWSA currently uses Innovyze InfoNet asset management software to manage and maintain the sewer system network mapping and inspection information. Sewer utility data is periodically exported from InfoNet to a Geodatabase to support the intranet mapping site. The water distribution system mapping is maintained in a Geodatabase and MWHSoft's InfoWater software application is used to hydraulically model the water network.

PWSA Goals

The PWSA has made significant strides toward integrating GIS and related technologies into its operational structure. Moving forward, it would be beneficial to enhance the organization's capabilities and capacity to perform GIS work and field data acquisition with in-house staffing, equipment, hardware and software. To meet these goals, creation of a new, full-time position to facilitate interaction between the construction services group and GIS analysts working in the Engineering Division is recommended. This position would be tasked with performing conformational GPS surveys of infrastructure, verifying as-built conditions, and integrating survey data and as-built information into the GIS databases as required. This position would serve as a foundation for the formation of a survey services group within the Engineering Division whose mission would be to ensure that the water and sewer mapping datasets remain current and up to date. Acquisition of a real-time kinematic (RTK) GPS unit would support the field survey efforts.

As the PWSA deploys its mapping data to field personnel, it will be increasingly important to provide staff with the latest hardware and GIS software applications, enhanced connectivity and targeted training. Wireless connectivity to the PWSA's mobile devices can be achieve via the 4G, high speed cellular network now established in this region. High bandwidth, wireless connections would enable a broader range of data, including CCTV information, to be pushed to field crews. Currently CCTV data can be viewed through InfoNet software, which is not accessible to field laptops. The CCTV data files are very large and it is not feasible to store them on the laptop at this time.

Short-Term Recommendations

It is recommended that the PWSA continue to develop and deploy ArcServer mapping applications to support operations and enhance responsiveness in critical situations such as those requiring access to valve and hydrant data.

It is also recommended that the PWSA upgrade its GIS data server capacity to support the future needs of the organization. The PWSA currently maintains its GIS and CCTV data on two (2) servers with a combined capacity of 5.5 TBytes (consisting of a 2 TB and 3.5 TB drive). The 3.5 TB drive is currently at capacity and the 2 TB drive is at 90% of capacity currently and contains only CCTV data associated with the Consent Agreement video inspection program.

Long-Term Goals

As the PWSA continues to develop a robust GIS dataset of its water and utility infrastructure, it will become increasingly important to leverage this information as an integral component of the capital improvement planning process using analytical tools such as MWH Soft's CapPlan. GIS information can be used to support, manage, and document on-going PM programs such as valve exercising, hydrant testing and flushing programs. Integrating the existing water system mapping into MWHSoft's InfoNet asset management software would enable the Authority to more effectively manage its water assets and inspection programs.

GIS can also support work-order and asset management programs through applications such as the Cogsdale ERP suite of software products, which the Authority is currently implementing. An integrated ERP/GIS solution would enable the organization to utilize utility information maintained in the GIS to manage work order tracking, preventative maintenance programs, historical repair data, asset inventories, and associated repair and replacement costs. Programs such as the on-going CSO work could also benefit from the implementation of an integrated resource planning system strategy.

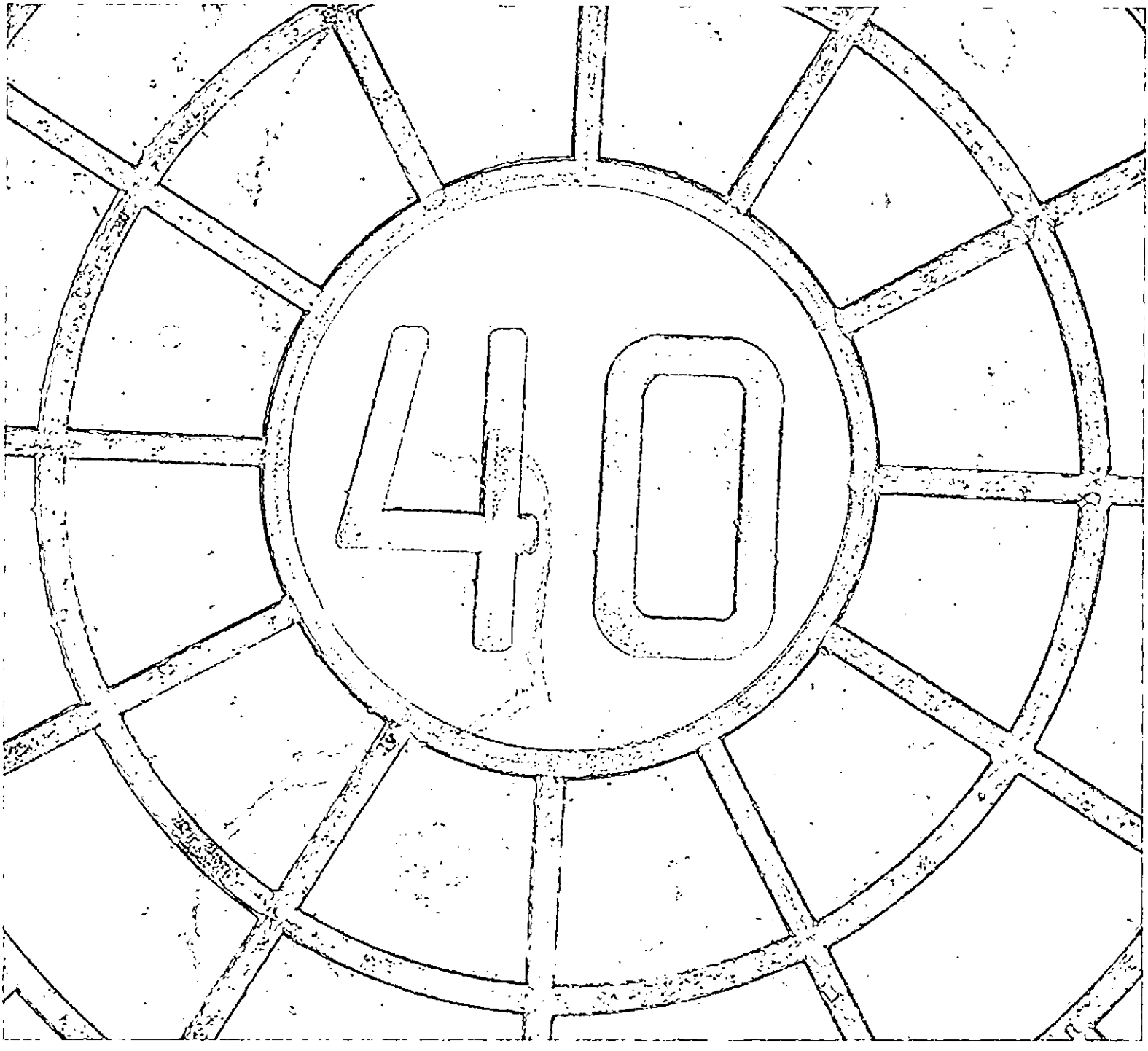
As the Authority becomes increasingly reliant on the utility information maintained in its GIS to support its operations, it will be imperative to ensure the accuracy of the water system mapping dataset. It is recommended that the PWSA undertake a comprehensive survey of its entire water distribution network using survey-grade GPS techniques to ensure the accuracy of its water network mapping. This effort would augment the on-going effort to map all large system valves as part of the valve exercising program managed by Wachs.

Estimated Capital Equipment Costs

The estimated capital costs for those items that have fixed costs are given in the table below. It is recommended that the training budget should be allocated for 3 staff members.

RTK GPS	$30,000
Additional laptops for field crews	$2,500 / laptop
3 days of training / year / person	$4,500 / year
ArcGIS Software Upgrade	$5,000
Wireless Connectivity to Mobile Users	$10,000 / year
GIS Server Upgrades	$5,000

TASK 4



THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR PLAN
TASK 4 - RECOMMENDED CAPITAL IMPROVEMENTS

4.1 FUTURE WATER DISTRIBUTION NEEDS

Sections 3.2, 3.3 and 3.4 presented a water system needs assessment that determined that, overall, the PWSA water distribution system is capable of adequately meeting the water demands of the service area through the next 40 years. However, the need for several sets of improvements was identified to address specific localized issues and improve system operability and reliability. This section identifies specific recommendations regarding those improvements. It is noted that the recommendations provided herein are conceptual in nature and are subject to additional feasibility and pre-design studies.

Increasing Service Pressures in Identified Problematic Areas

The water distribution system is capable of satisfying the identified target minimum service pressures throughout the system. However, there are two areas where lower than desired pressures are a concern. One area consists of locations at higher elevations in Millvale that report pressures as low as 30-psi. Millvale is currently supplied from the PWSA 60-inch main on East Ohio Street and the volume of supply is more than adequate. However, pressures in the 60-inch main are insufficient to adequately reach the higher elevations in the Borough. This situation was confirmed by modeling.

Based upon feasibility studies performed by the PWSA, it is proposed that the problematic higher elevation areas in Millvale be supplied by constructing an in-line booster pump station to supply water to Millvale. This station would take water from the 60-inch transmission line and send it to the existing Millvale tank. The currently estimated construction cost for this work is approximately $500,000.

The second area consists of an area in Bloomfield along Penn Avenue roughly between 44th Street and Fairmount Street, along Friendship Avenue between Atlantic Avenue and Emory Way and along Harriet Street between Gross Street and Graham Street. This is an active redevelopment area in which existing customers report persistent low pressure problems. The area is served by the Highland 1 Reservoir District, but is immediately adjacent to the Bloomfield Regulator District. Expanding the Bloomfield Regulator District has been identified as a feasible means of sufficiently increasing service pressures in this area. The following recommended improvements to increase pressures have been identified. A general layout of these improvements is presented in Figure 4-1.

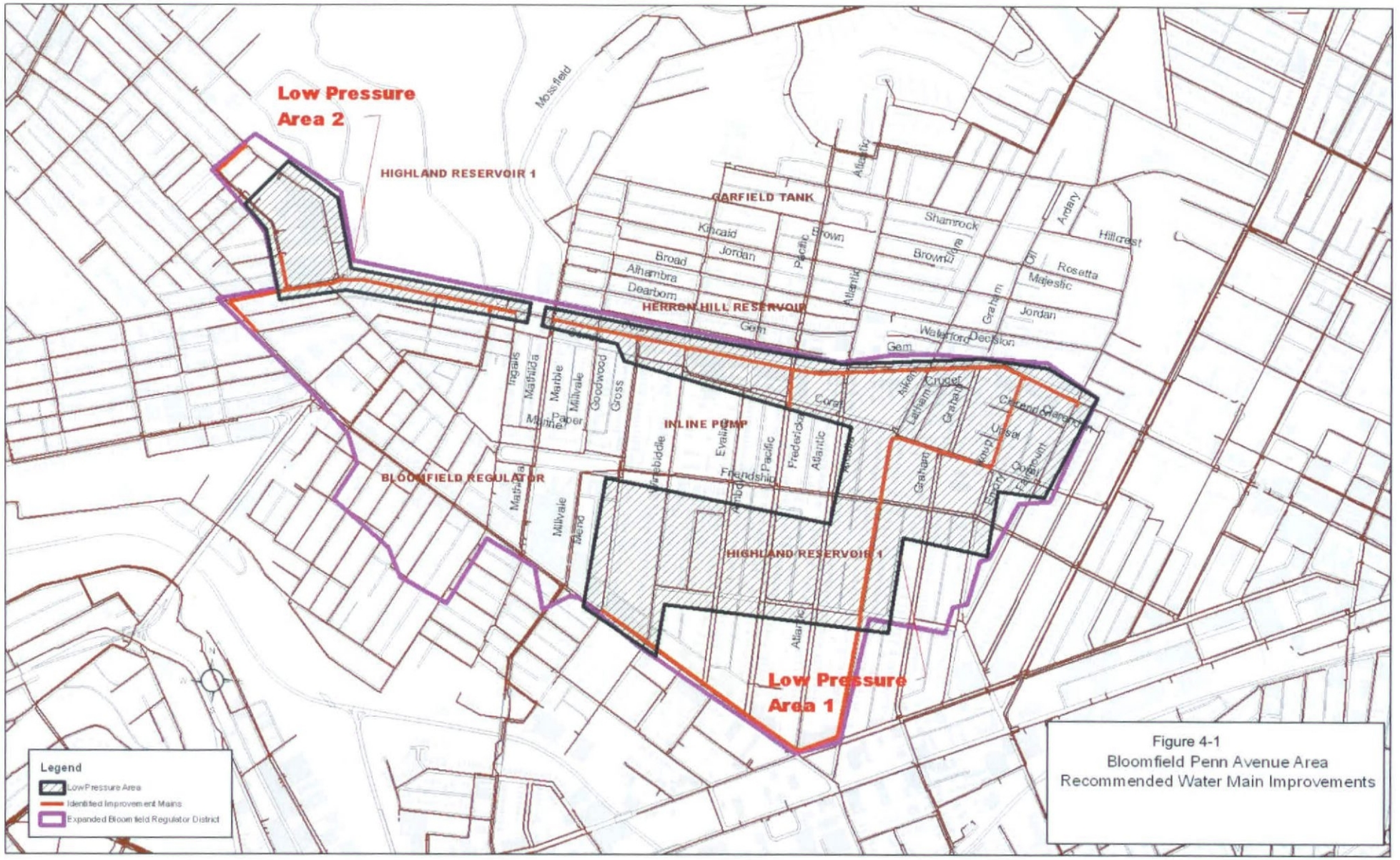


Figure 4-1
Bloomfield Penn Avenue Area
Recommended Water Main Improvements

- Make a connection to the discharge side piping from the existing Mathilda PRV at Penn and Mathilda to the following new mains: 3,980-feet of 12-inch main on Penn Avenue; 690-feet of 12-inch main on Roup Street; 760-feet of 12-inch main on Coral Street; 1,800-feet of 12-inch main on Aiken Street; 310-feet of 12-inch main on Baum Boulevard; and 1,800-feet of 12-inch main on Liberty Avenue. Install 1,430-feet of 8-inch main on Penn Avenue; 300-feet of 8-inch main on Main Street, 280-feet of 8-inch main on 44th Street, and 280-feet of 8-inch main on Sherrod Street.
- Position dividing pressure gates to expand the Bloomfield Regulator District as illustrated Figure 4-1, including the current Inline Pump District. This will enable the inline pump station to be eliminated.

The estimated construction cost for these improvements is $3,800,000.

Reducing the Size of the Herron Hill Reservoir District

Expanding the Bloomfield Regulator district would shift approximately 0.75-mgd of water demand from the Highland 1 Reservoir District to the Herron Hill Reservoir District under maximum day demand conditions. The Herron Hill District is currently taxed and there is a concern that shifting this amount of demand to the Herron Hill Reservoir District will place too great a demand on the facilities. The projected year 2051 demand on the Herron Hill Reservoir Pump Station under the service area current configuration is approximately 21.4-mgd. Adding the Bloomfield demand would increase the total demand to 90-percent of the nominal rated capacity of the station. A concept that has been advanced for addressing this situation consists of expanding the Lincoln Service District into a portion of the Herron Hill Reservoir District. This modification to the configuration of the PWSA water distribution system would reduce the demand on the Herron Hill Reservoir Pump Station and Herron Hill Reservoir by reducing the size of the district served. It would also offer the benefits of expanding the Lincoln Tank District into higher elevation areas of the Herron Hill Reservoir District and improve working pressures and creating an emergency secondary feed to the Squirrel Hill District from the Lincoln District. Expansion of the Lincoln District as envisioned would shift approximately 4.5-mgd of demand under maximum day conditions from the Herron Hill Reservoir District to the Lincoln District. This expansion would require upsizing the Lincoln Pump Station to a capacity of 6.7-mgd, increasing the storage volume in the Lincoln District to 5.2 million gallons, the construction of 11,300-feet of 20-inch and 12-inch diameter transmission main from the Lincoln District into the expanded service area and the construction of a point of emergency connection to the Squirrel Hill District.

A preliminary general layout of the modified service district boundaries and the facilities required to accomplish those modifications is presented in Figure 4-2. The estimated construction cost for these improvements is $9,500,000.

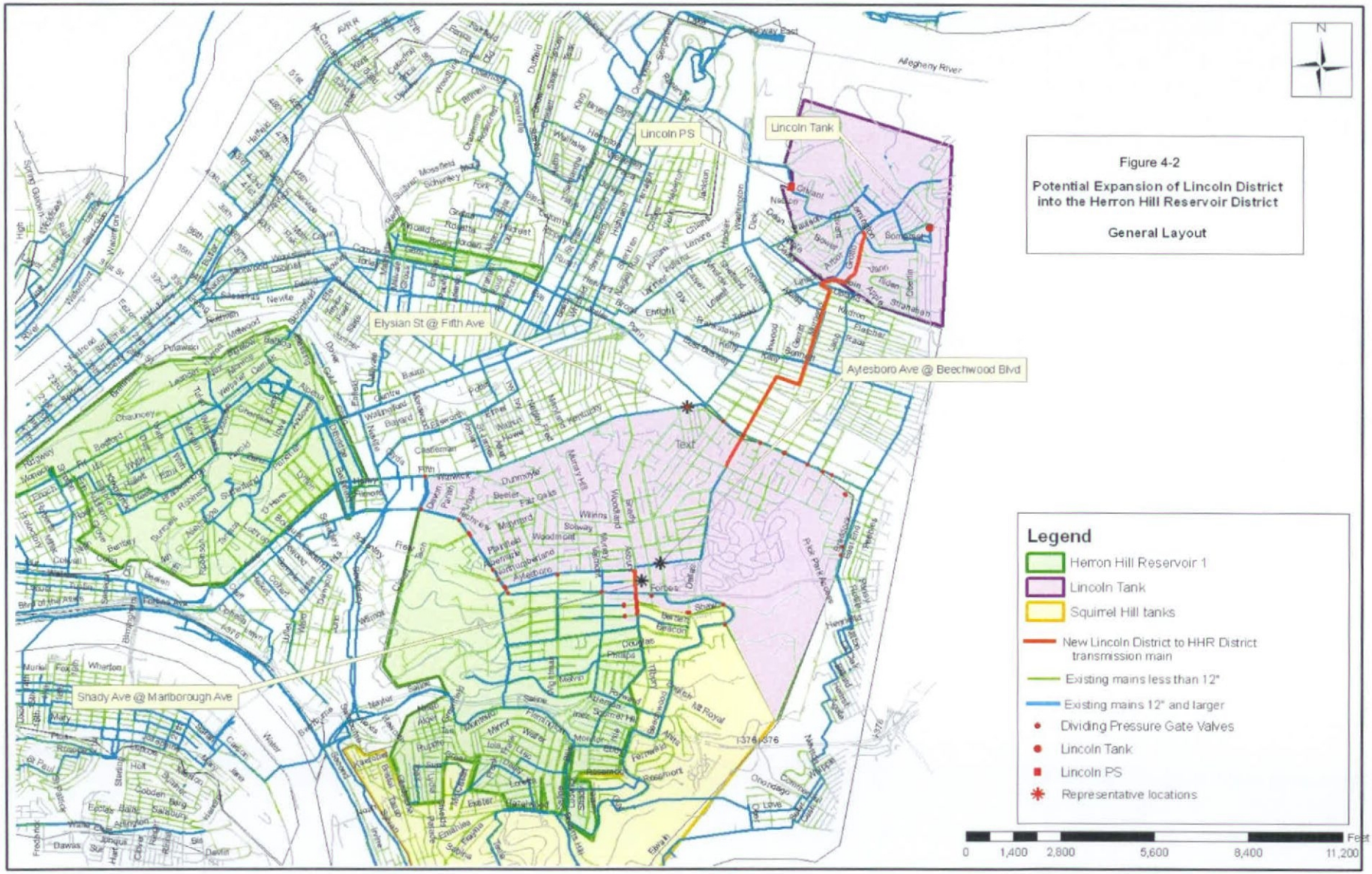


Figure 4-2

Potential Expansion of Lincoln District into the Herron Hill Reservoir District

General Layout

Providing Additional Pumping and Storage Capacity

The needs analysis presented in Section 3.2 evaluated existing pumping and distribution storage capacities under projected 2051 demand conditions. That analysis determined that the nominal rated capacity of the Inline Booster Station is less than the projected maximum day demand for the area served by the station. However, as discussed above, the recommended expansion of the Bloomfield Pressure Regulator District could eliminate the need for operating the Inline Pump Station. This would avoid the need for providing additional pumping capacity at that pump station. The proposed expansion of the Lincoln District into the Herron Hill Reservoir District will require increasing the capacity of the Lincoln District pump station to 6.7-mgd.

The needs analysis determined that the existing storage capacity does not satisfy the sizing criteria under maximum day conditions for the following service districts: Herron Hill Reservoir District, Herron Hill Tank District, and the Garfield Tank District. The needs analysis also identified the advisability of replacing/supplementing the storage in the Squirrel Hill District. The proposed expansion of the Lincoln District into the Herron Hill Reservoir District will require increasing the storage volume in the Lincoln District to 5.2-MG. However, this would avoid the need for increasing storage in the Herron Hill Reservoir District.

The actions required to address the identified distribution pumping and storage needs are as follows:

- Upsize the Lincoln Pump Station to a nominal rate capacity to 6.7-mgd.
- Increase the storage volume in the Herron Hill Tank District to 1.3-MG.
- Increase the storage volume in the Garfield Tank District to 2.9-MG.
- Provide a total of 2.8-MG of usable storage in the Squirrel Hill District.
- Increase the storage volume in the Lincoln District to 5.2-MG.

Where possible, two tanks will be used instead of one to improve storage redundancy. The estimated costs for these improvements are presented in Task 4.11.

Constructing a Highland 2 Reservoir District to Highland 1 Reservoir District Pump Station

The construction of a pump station capable of transferring water from the Highland 2 Reservoir to the Highland 1 District has been proposed. The proposed transfer pump station will provide that ability to supplement the supply of water into the Highland 1 District in the event that the normal supplies of water to the Highland 1 District are reduced or curtailed, significantly improving the reliability of the distribution system. A 32-mgd capacity transfer pumping station with a diesel powered generator and 12,500 feet of 42-inch pipe have been proposed. A second, separate electrical feed to the

Membrane Filter Plant has also been recommended as a part of these improvements. The estimated construction cost of these facilities is $4,600,000.

Improving Hydrant Flow Capacities and Addressing the Aging Piping Infrastructure

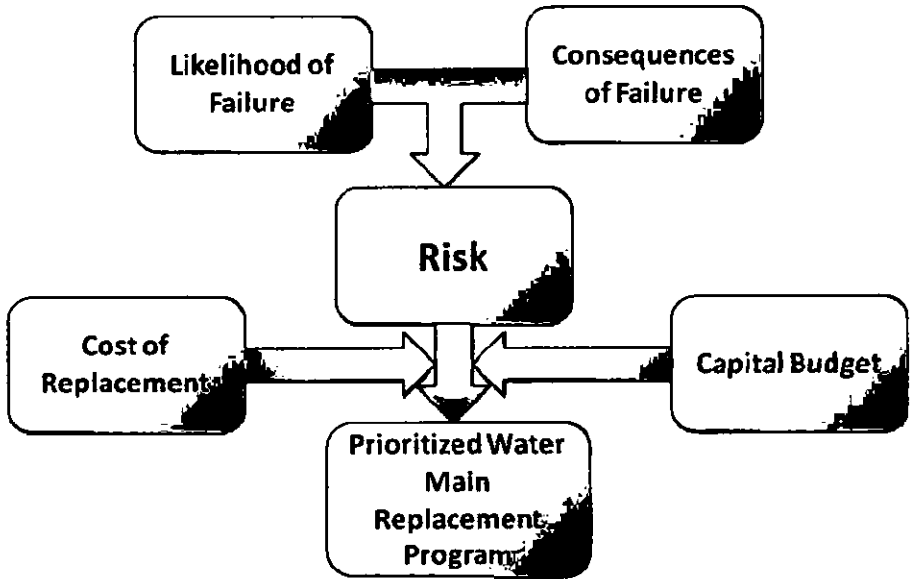
Hydrant flow testing and computer modeling have identified specific areas in the water distribution system that are in need of improved fire flow delivery capabilities. Investigations into these situations have determined that, in most cases, reduced fire flow capacity is attributable to small diameter, old pipes. A significant percentage of the water mains in the PWSA system are more than 70-years of age (a generally accepted estimated of the useful life of cast iron mains). In addition to losing capacity aging pipes become increasingly vulnerable to structural failures and are plagued by water main breaks of increasing frequency and severity, excessive leaks, and catastrophic failure resulting in large water losses, flooding, property damage, and community disruption. Addressing these issues can be accomplished through the implementation of an ongoing water main repair and replacement program. The PWSA's capital improvements programs (CIP) have included water main replacement elements. However, to be effective, the 40-year capital plan must include a substantially more aggressive water main replacement program that is supported by a decision support system that can better target mains for replacement and provide a tool for CIP planning.

4.2 WATERLINE RISK BASED ANALYSIS

As part of the development of the 40-year plan, the CapPlan software was used to develop a risk based water main replacement/rehabilitation program. The basic concept is that investments in water main replacement/rehabilitations should be targeted to most effectively minimize risk to the system. A complete understanding of risk requires the simultaneous consideration of the **probability of failure** of pipe components (i.e., how likely is it that a pipe will fail?) and the **consequences of failure** (i.e., if a pipe does fail, how will it impact the system and community?). Quantifying the relative risk of failure of pipes in the distribution system can provide a rational and defensible basis for developing a fully prioritized water main replacement/rehabilitation program that can be incorporated into an overall long-range plan and CIP and tailored to available capital budgets. Once individual pipe segments have been prioritized based upon risk, costs for replacement/rehabilitation have been estimated and capital budgets have been defined, specific main replacements can be assembled into an on-going program. This process is illustrated in Figure 4-3.

The PWSA's InfoWorks WS based hydraulic model of the distribution system was imported into the InfoWater/CapPlan modeling platform in order to permit the use of the CapPlan software.

Figure 4-3: Risk Based Water Main Replacement/Rehabilitation Development Process



Measures of the **probability of failure** of pipes were developed empirically using historical water main break records and specific pipe characteristics. A detailed, GIS based analysis of water main break records spanning the period 1989 to mid-2010 was performed in order to assign individual main break occurrences to specific pipe segments. A total of 5,100 individual main breaks were mapped to specific pipe segments. Relevant characteristics of specific pipe segments were determined using information contained in the PWSA's geographic information system (GIS), computer modeling results and other sources. The following pipe characteristics were defined: 1) estimated pipe age, 2) pipe diameter, 3) normal working pressures and 4) the natural corrosiveness of the soils in which the pipe is located. Each of these factors is thought to affect the probability of failure of pipes.

Figures 4-4 through 4-7 illustrate the empirical relationships between main break frequency and the four pipe characteristics listed above.

Pipe segments with similar characteristics were combined into bins of pipes with common characteristics. The historical frequency of water main breaks of pipes within each bin were computed in terms of the number of breaks that occurred per year per mile of pipe for all of the pipes within each characteristics bin. This served as the empirically derived measure of the probability of failure. Figure 4-8 presents the break frequency of PWSA pipes by pipe characteristics bin.

Figure 4-4
Empirical Relationship: Main Break Frequency vs. Pipe Age

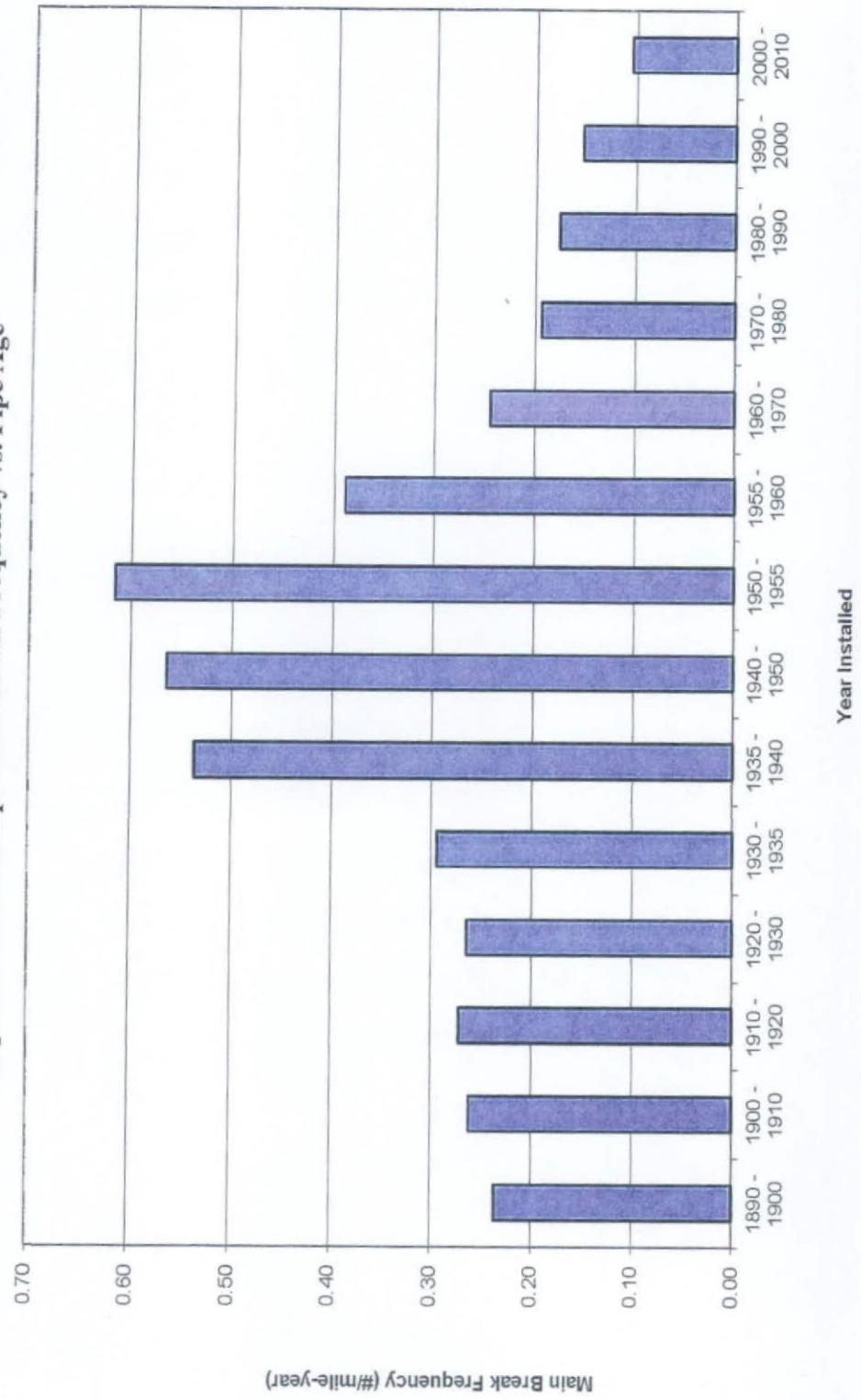
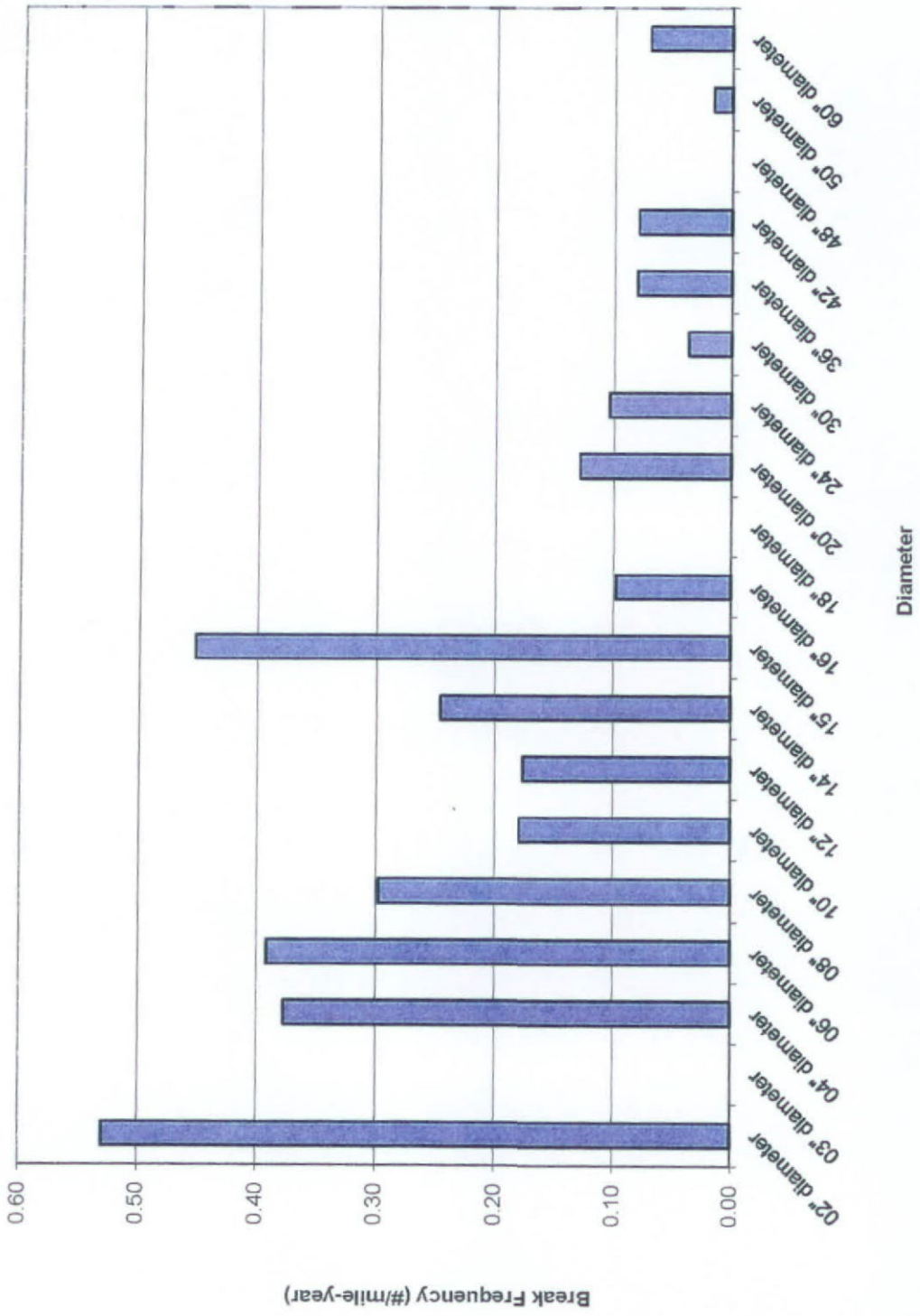


Figure 4-5
Empirical Relationship: Main Break Frequency vs. Pipe Diameter



CHESTER ENGINEERS

Figure 4-6
Empirical Relationship: Main Break Frequency vs. Soil Corrosivity

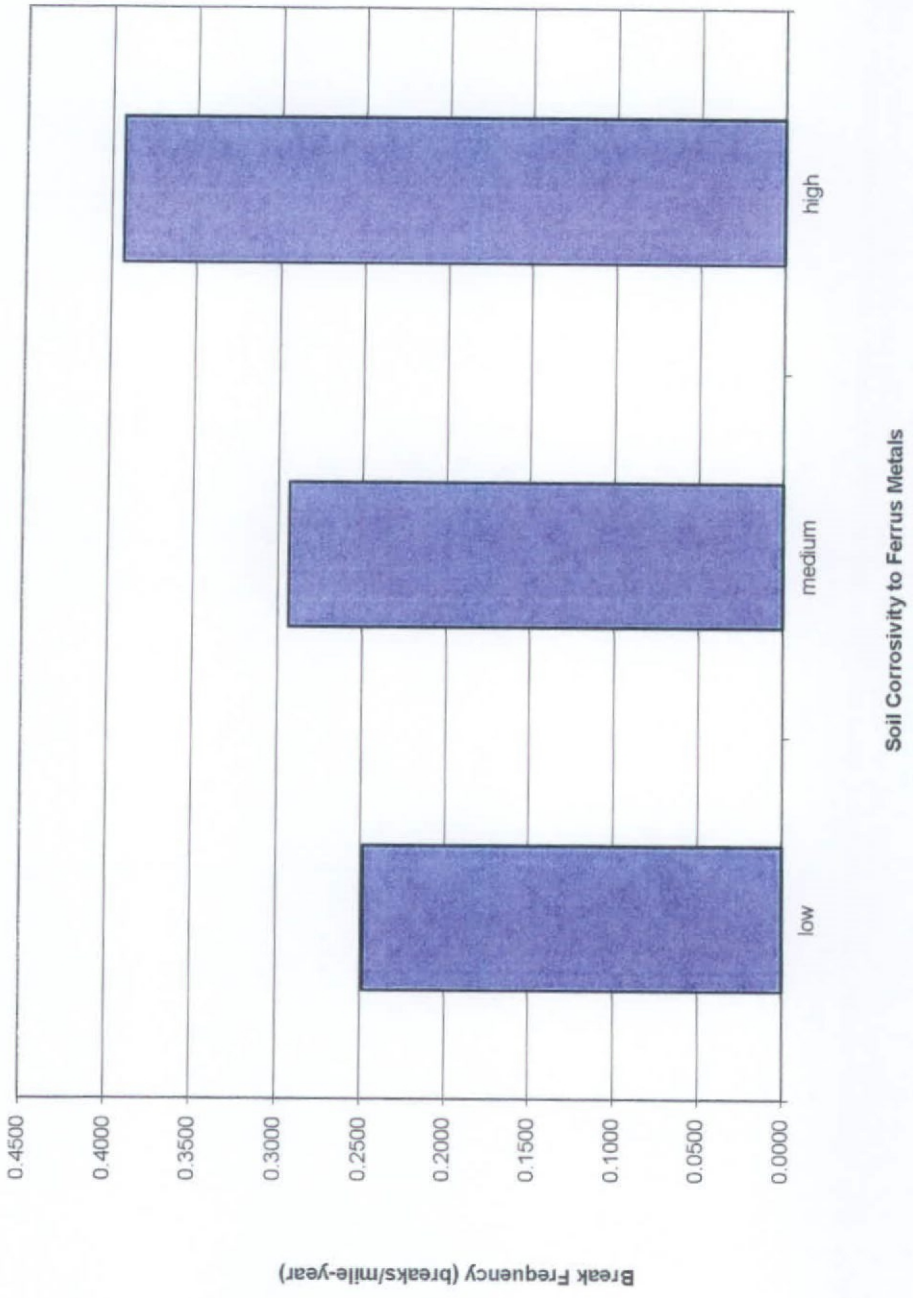


Figure 4-7
Empirical Relationship: Main Break Frequency vs. Normal Working Pressure

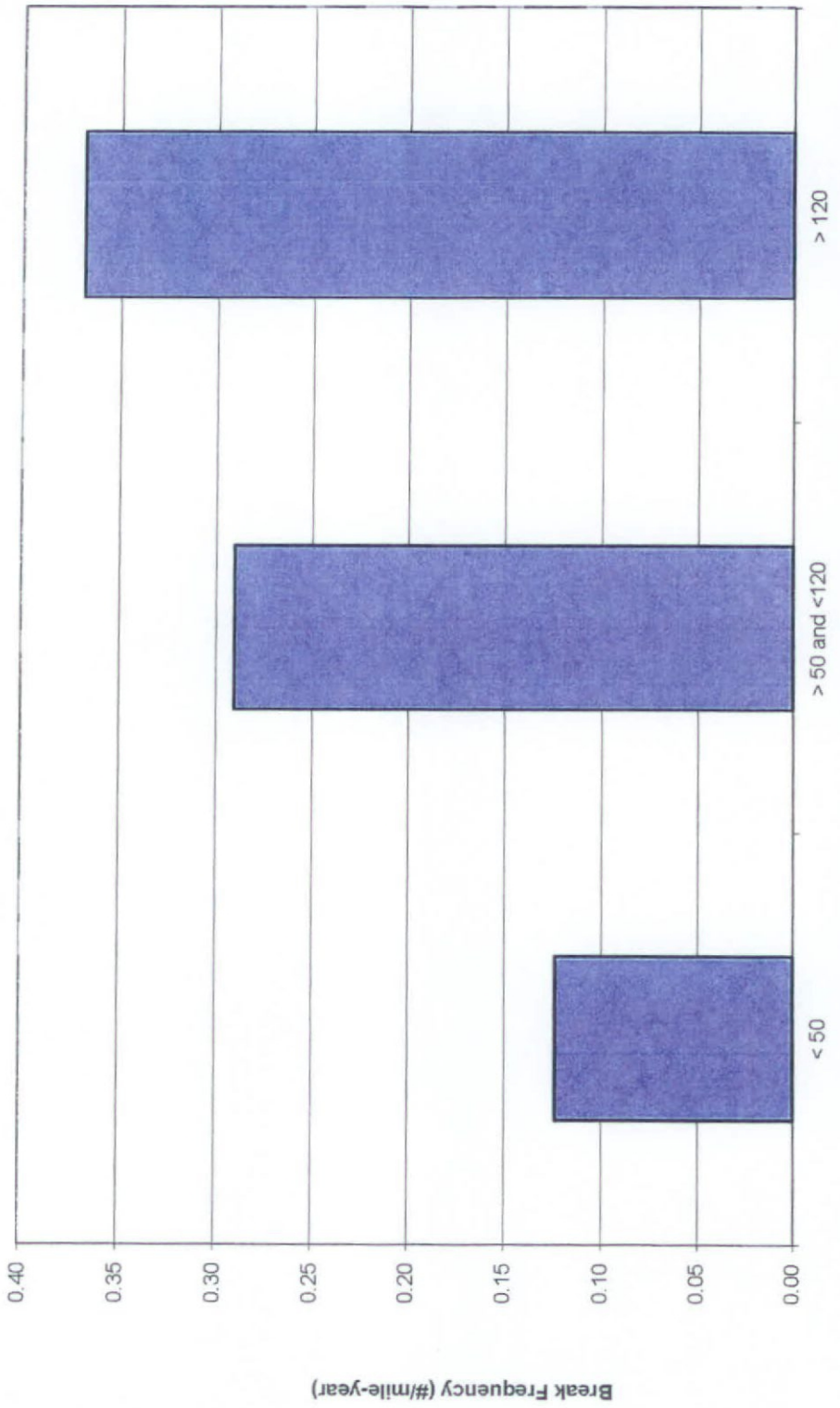
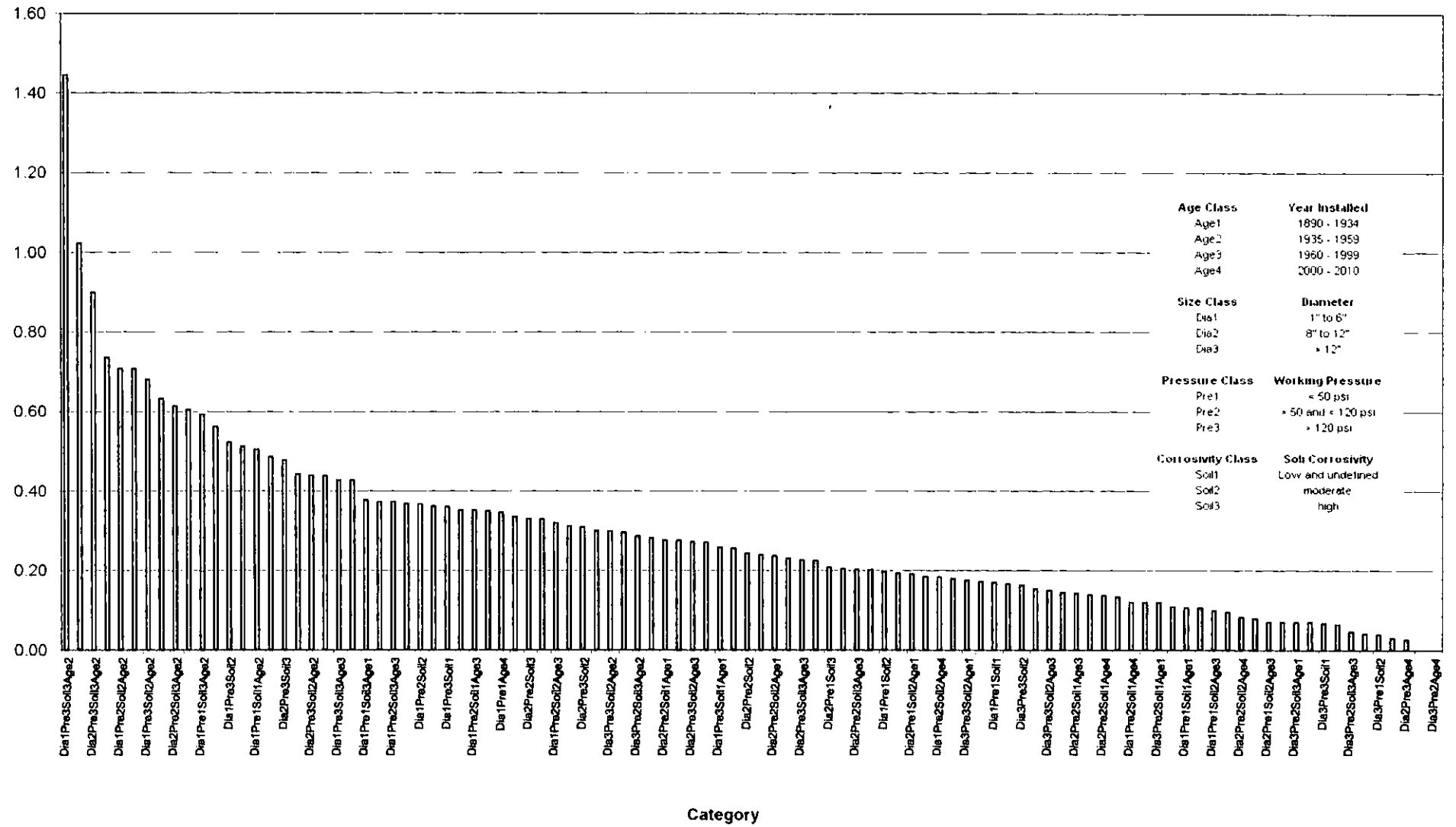


Figure 4-8
Likelihood of Failure Main Break Frequency Analysis



The following measures of the **consequences of failure** were developed: criticality to overall system operation (identified major transmission mains), effects on critical customers (measures of the extent to which a failure of each main segment would affect service to hospitals), locations in high impact areas (identified water mains within major commercial/institutional/high traffic areas where failures would potentially produce highest property damage and community disruption), size of area affected by required repair shut down (InfoWater/CapPlan estimates of the number/length of mains affected by main break repair shut downs), rate of flow disrupted (InfoWater/CapPlan computations of the typical rates of flow through main segments), and proximity to low hydrant flow capacity locations (locations determined through an analysis of hydrant flow test results data).

The software was used to calculate the risk associated with each pipe segment as the consequences of failure score multiplied by the probability of failure score. The computed risk provided the measure used to prioritize specific water main segments for replacement/rehabilitation.

Cost estimates for the replacement/rehabilitation were developed based upon experience with PWSA projects and recent materials pricing information. It is anticipated that pipes to be replaced will be replaced with pipes of the same size except that pipes 6-inches and smaller in diameter will be replaced with 8-inch mains. It is also anticipated that mains 24-inches in diameter and larger will be rehabilitated via pipe lining.

The CapPlan program was used to develop a budget for replacing/rehabilitating all pipe segments that the program identified as having medium to high risk of failure. Pipe segments identified as having a low to negligible relative risk were not scheduled for replacement/rehabilitation during the 40-year capital planning period. In order to rehabilitate/replace the medium to high risk mains, the program determined that approximately $14.8 million per year (project cost in current dollars) will have to be spent over the next 40 years. Figure 4-9 illustrates the water mains identified for prioritized replacement/rehabilitation during the 40-year planning period. Figures 4-10 through 4-17 illustrate the mains identified for replacement/rehabilitation during each five year phase of the capital plan. An ArcMap shapefile containing data that identifies the pipes scheduled for replacement by 5-year phase intervals, the size and length of the pipe segments and the estimated cost for replacement/rehabilitation has been provided separately in digital form. The approximate lengths of main identified for replacement/rehabilitation during each phase of the capital plan are presented in Table 4-1. According to this schedule, approximately 945,000 feet of pipe would be replaced/rehabilitated over the 40 period, equating to 19-percent of the total length of pipe in the system. This equates to an annual replacement/rehabilitation rate of approximately 0.5-percent per year. The USEPA's 2006 Community Water System

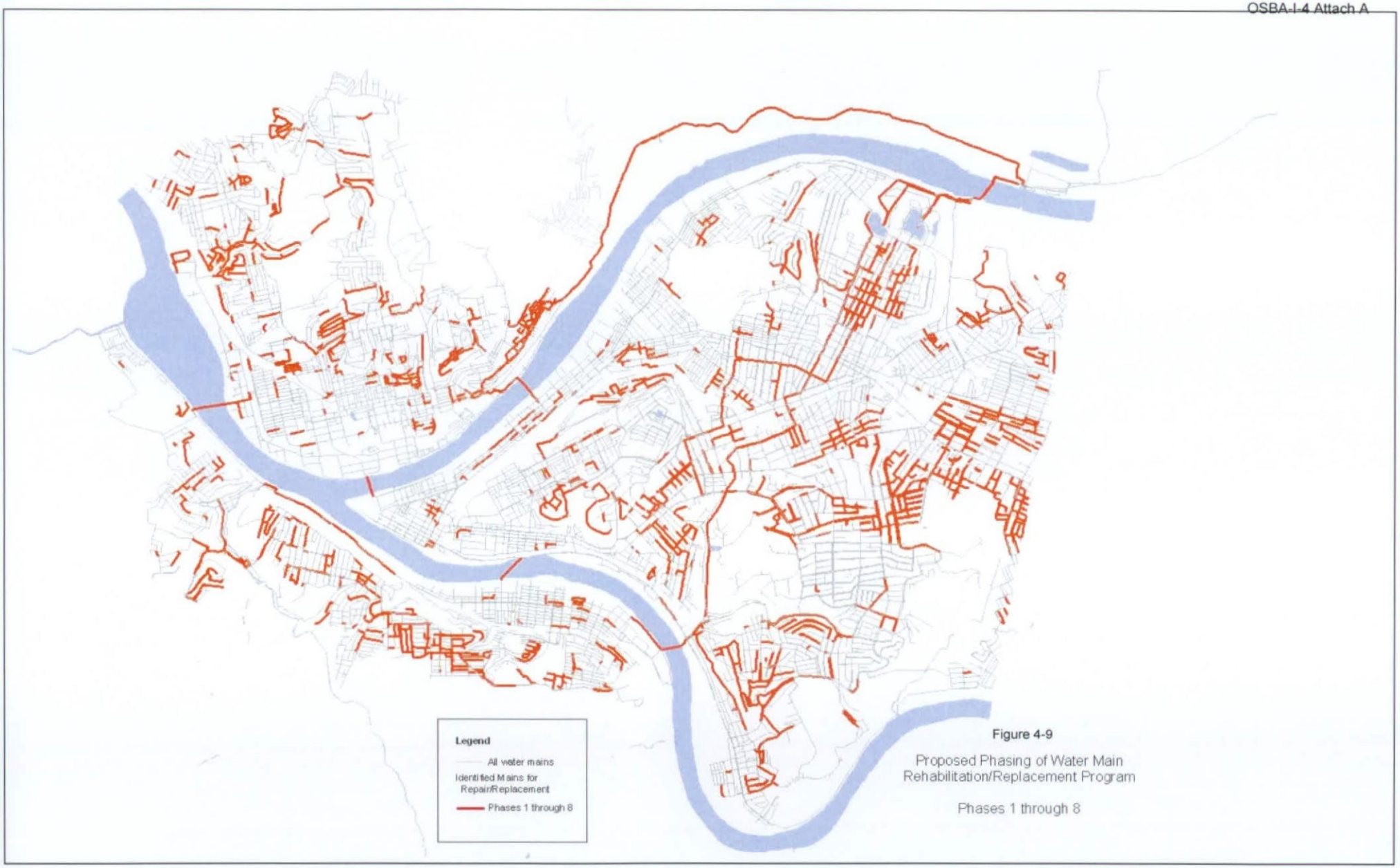


Figure 4-9

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phases 1 through 8

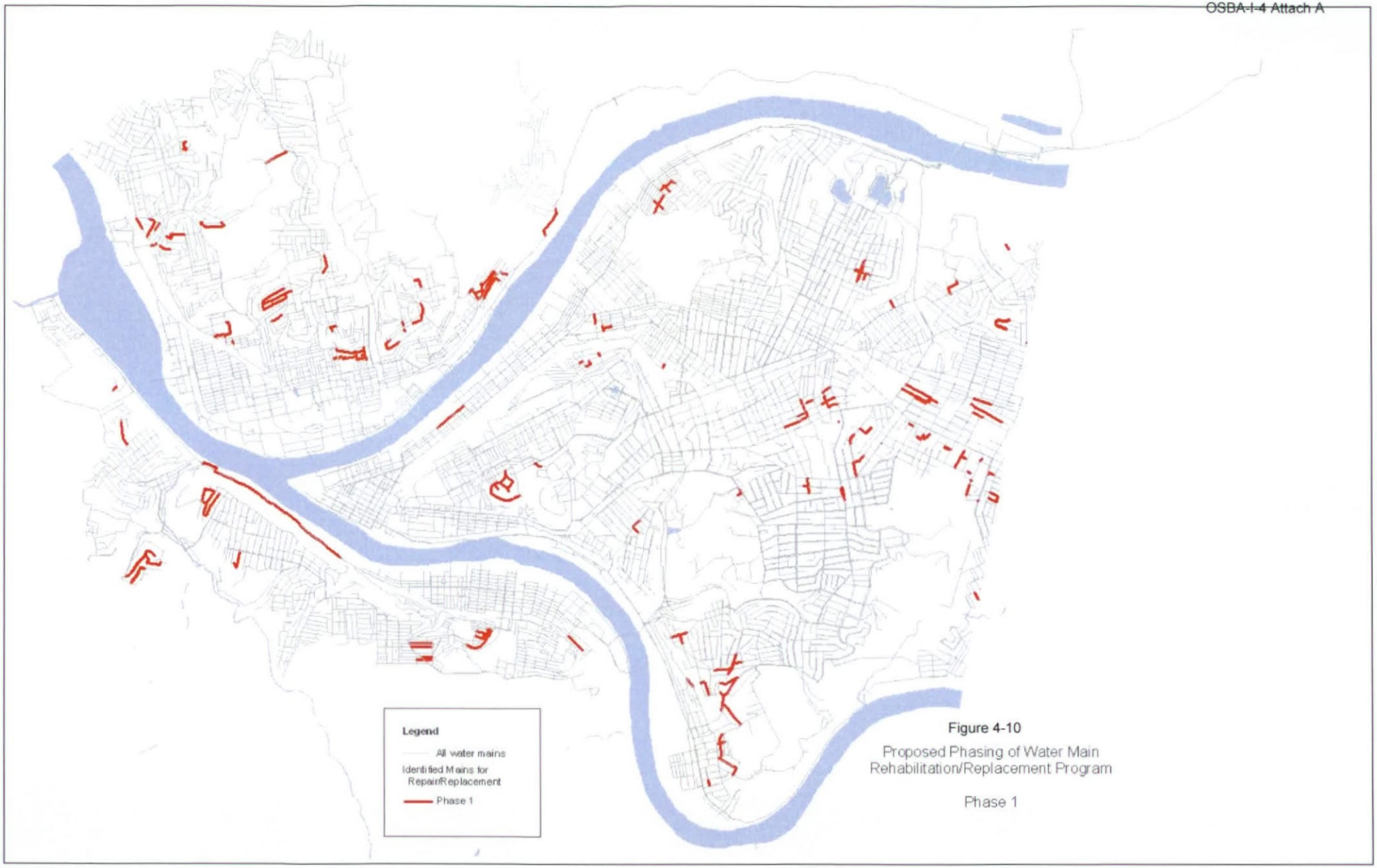


Figure 4-10

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 1

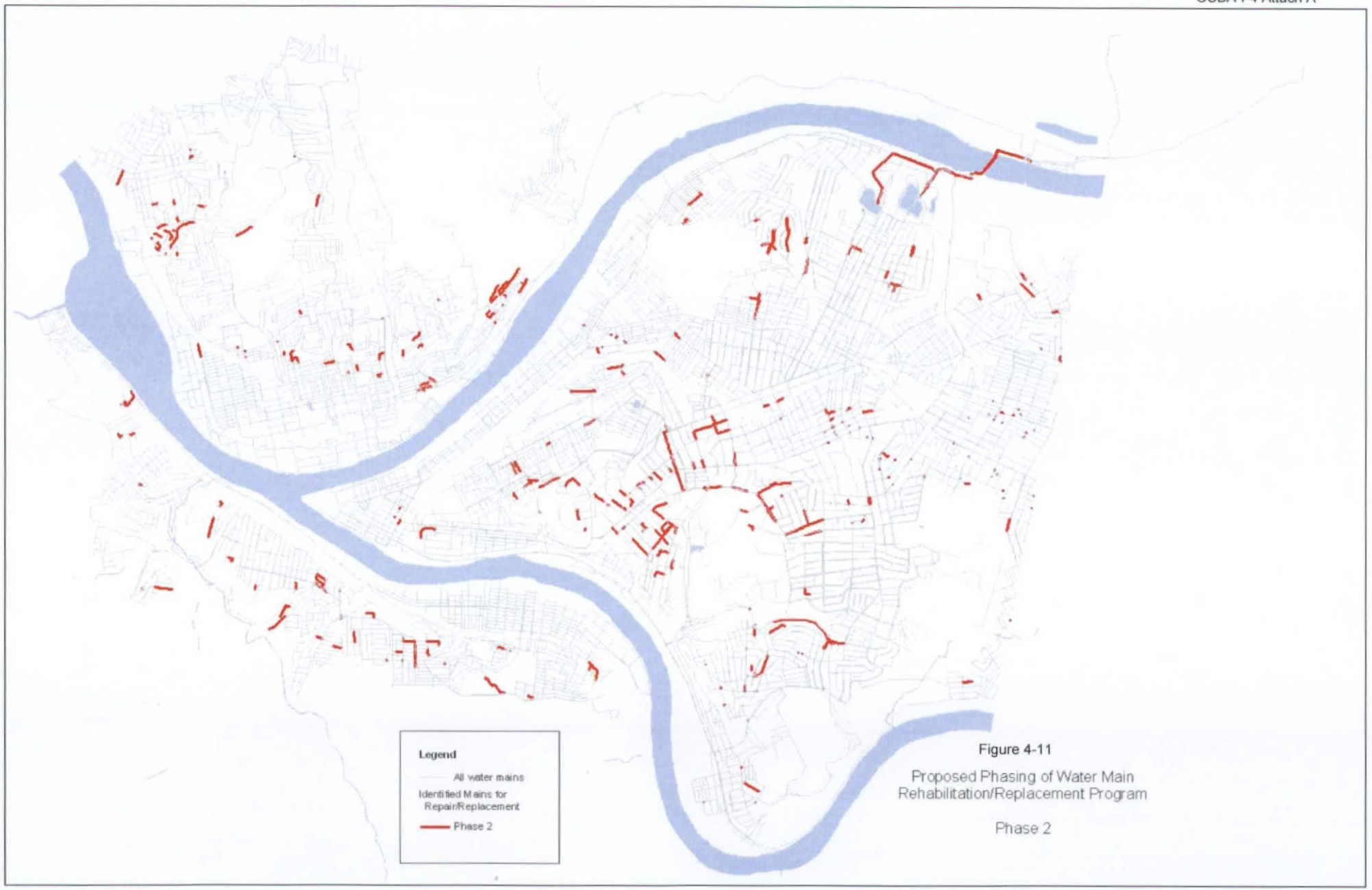


Figure 4-11

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 2

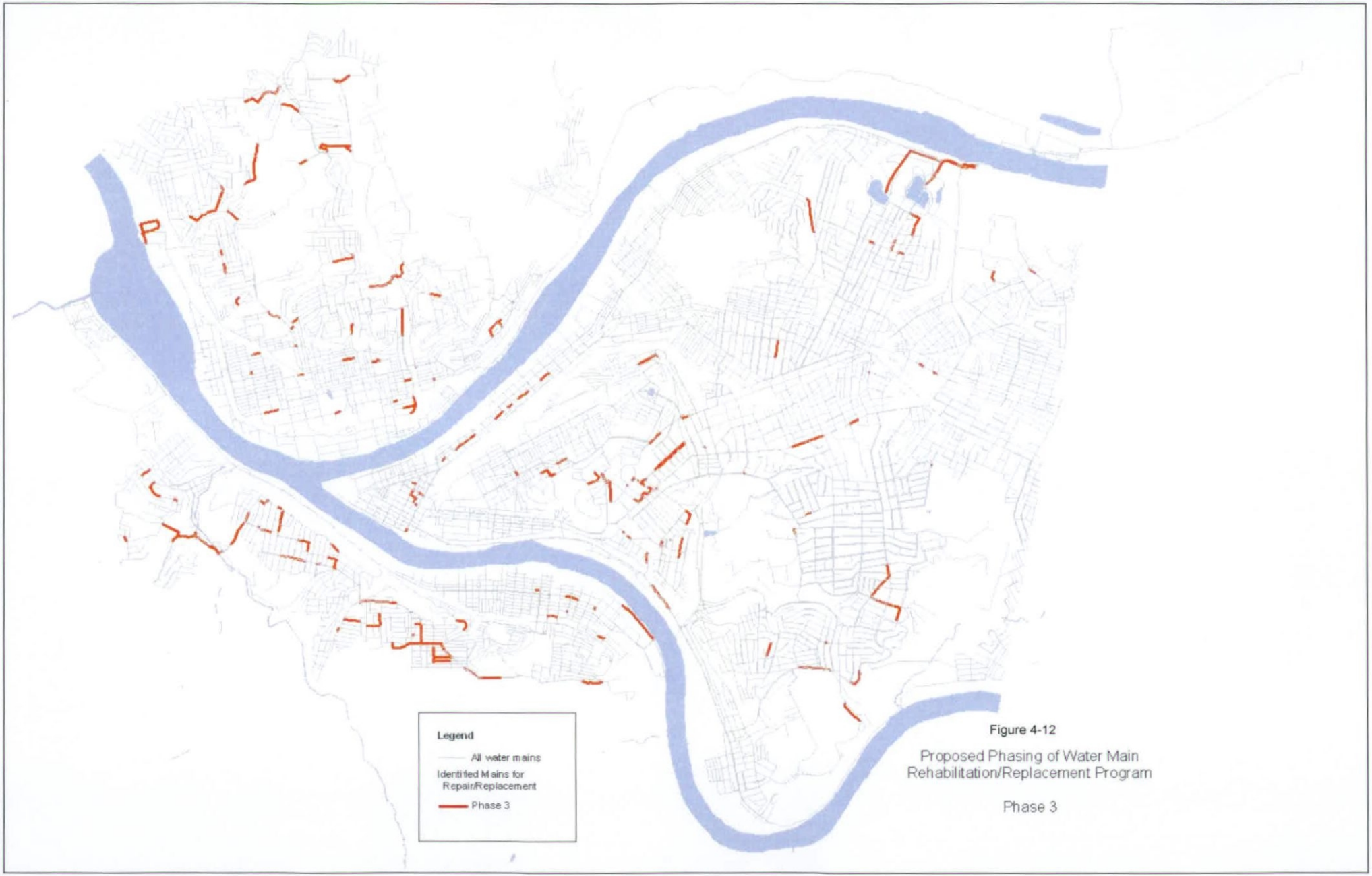


Figure 4-12

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 3

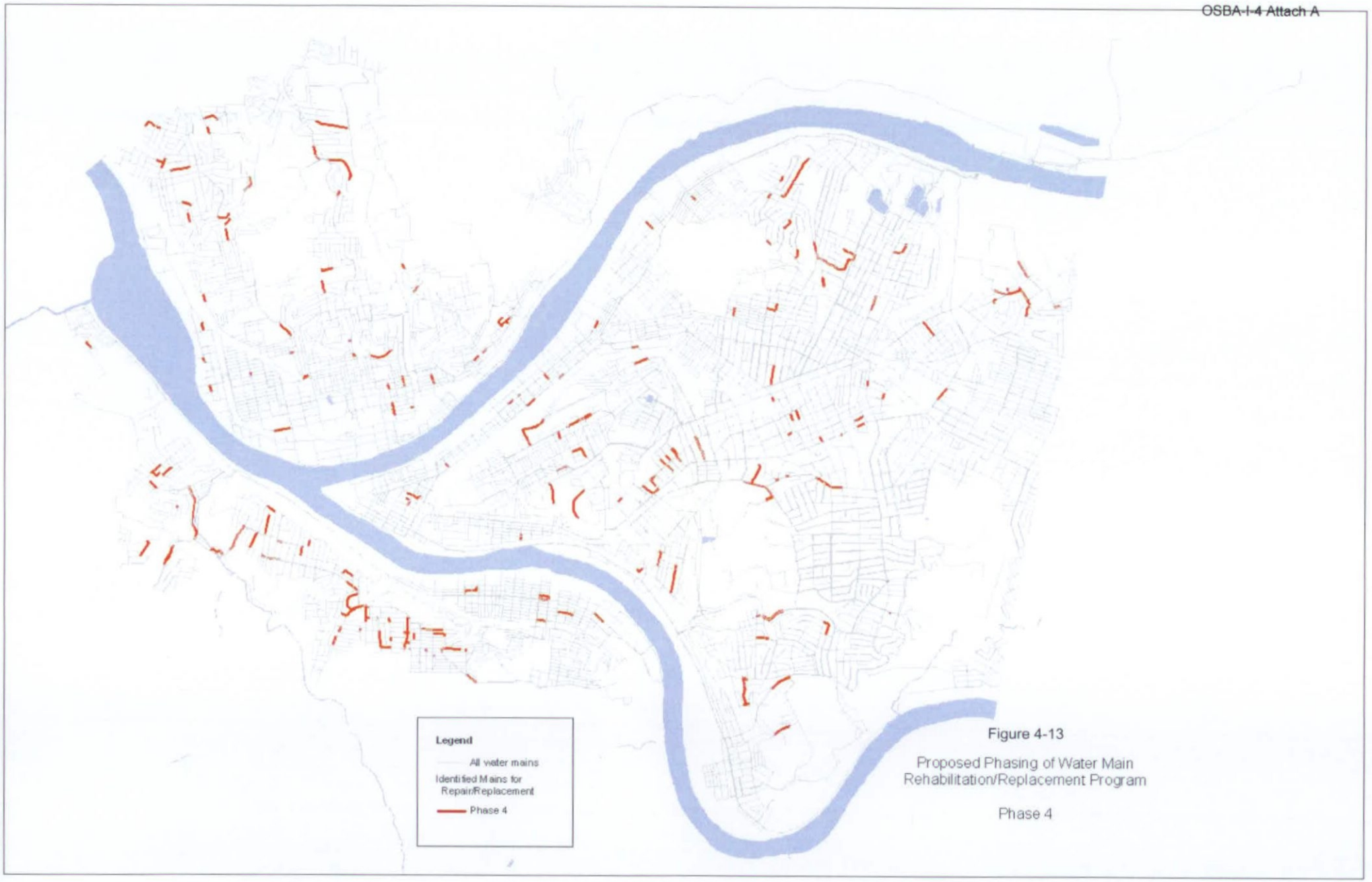


Figure 4-13

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 4

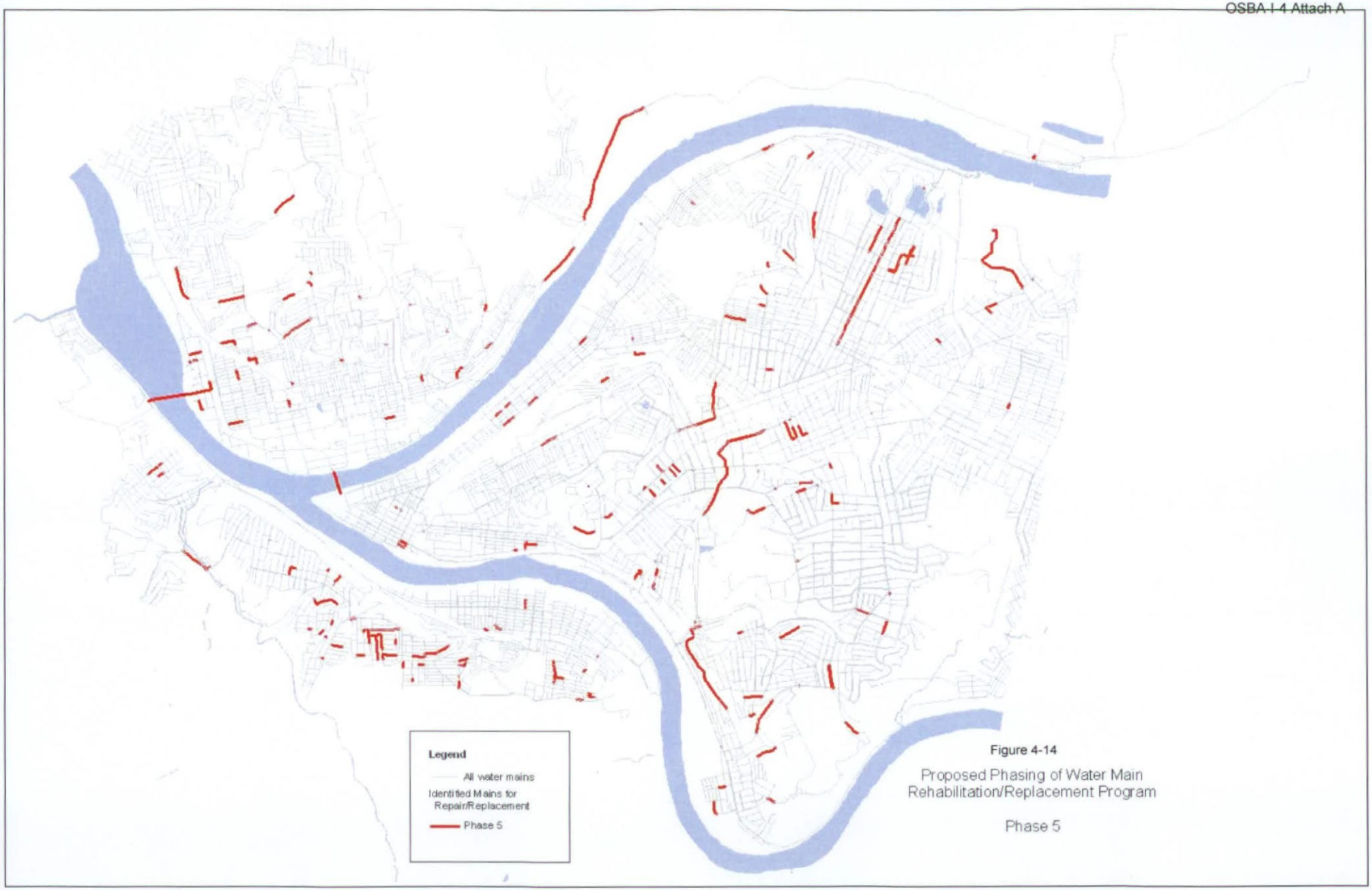


Figure 4-14

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 5

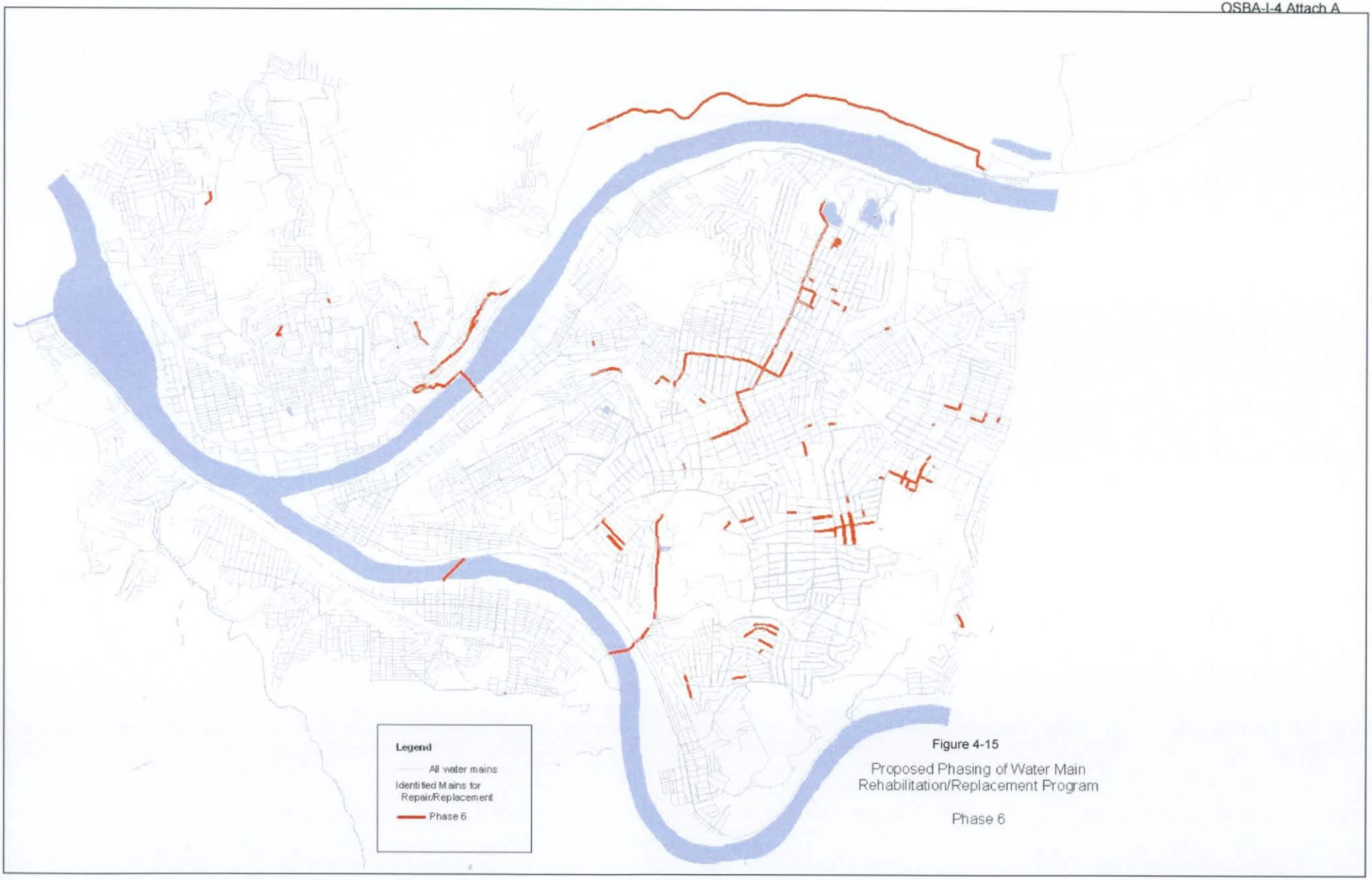


Figure 4-15

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 6



Figure 4-16

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 7

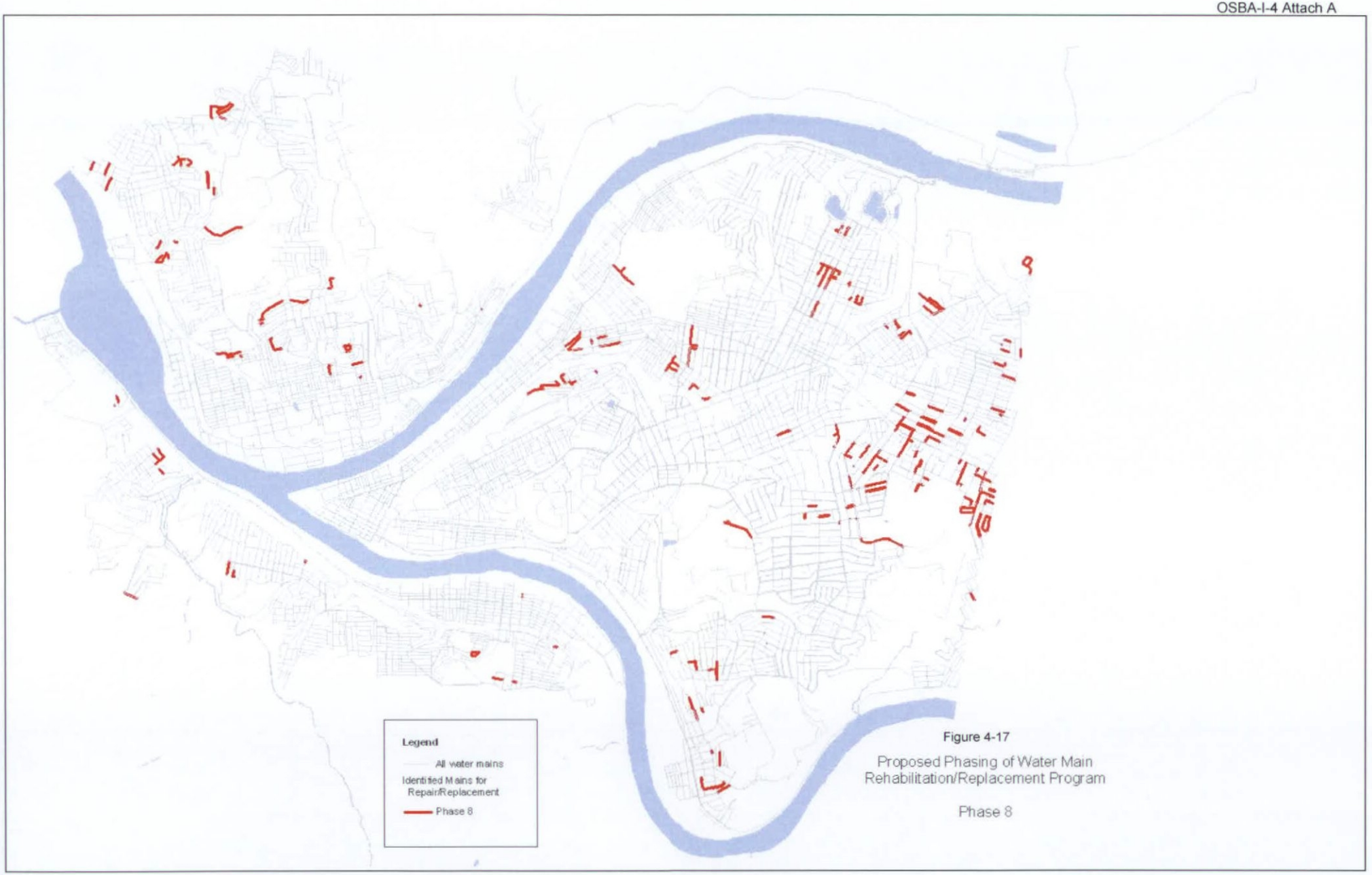


Figure 4-17

Proposed Phasing of Water Main Rehabilitation/Replacement Program

Phase 8

Survey reports that the median annual water main replacement rate during the previous five years for systems serving 100,001 to 500,000 persons was 0.2-percent per year. The mean replacement rate reported for this size range of systems was 0.4-percent.

Table 4-1
Proposed Water Main Replacement/Rehabilitation Program

Phase	Total Project Cost (Dollars)	Total Length (feet)	Percent of Total System Length (%)
1	72,300,000	117,000	2.3
2	78,200,000	125,000	2.5
3	76,200,000	117,000	2.3
4	72,200,000	116,000	2.3
5	71,000,000	114,000	2.3
6	73,600,000	116,000	2.3
7	74,800,000	122,000	2.4
8	71,900,000	118,000	2.4
Totals	590,200,000	945,000	18.9

4.3 WATER TREATMENT PLANT ASSESSMENT

Concept Level Improvements to the Water Treatment Plant

Based on the projected future water demands developed under Task 3.4 and the discussions in Task 4.4, no additional treatment capacity will be needed during the 40-year planning period. Projections indicate that the current 117 mgd of water treatment capacity will be adequate to meet future needs. However, periodic upgrades and enhancements to existing facilities will be required to maintain efficient and effective treatment.

When PWSA was created in 1984, its primary function was to oversee a capital improvement program to refurbish the water system infrastructure, including the water treatment plant. In the 1980's, the following projects were undertaken to upgrade facilities at the Aspinwall site:

- Clarifier sludge collector replacement.
- Clarifier joint repairs.
- Roof replacements.

- General, HVAC, and electrical improvements to Ross pump station.
- Traveling water screen rehabilitation.
- General, HVAC, and electrical improvements to water treatment plant.
- General, mechanical, and electrical improvements to filters.
- General, mechanical, and electrical work to cover clarifiers.

In the early 1990's, projects were completed to remove accumulated solids from the sedimentation basins, rehabilitate the sedimentation basins, and upgrade the chemical feed systems.

In the past few years, the useful lives for projects that were completed in the 1980's have been reached and the replacement cycle for facilities and equipment has begun again. Recent projects include switchgear upgrades at the Ross pump station, clarifier joint repairs, replacement of clarifier sludge collectors, replacement of traveling water screens, and rebuilding pumps at the Ross pump station. In the near future, the filters will need to be rehabilitated again and the solids build up in the sedimentation basins will have to be removed.

A filter rehabilitation project has been designed for the Aspinwall treatment plant. The general construction portion of the project will replace the existing filter media and underdrains, install new air scour piping, re-level existing washwater troughs and install new washwater troughs, replace valves and hydraulic operators, rehabilitate existing valves, and repair the backwash pump. The electrical construction component of the project will install new instruments, controls, and include related electrical work. A permit application for the project was submitted to the PADEP in September 2010. Drawings and specifications for the project were submitted for PWSA review in April 2011. Per an April 2009 cost estimate by CDM, the total construction cost for the project is projected to be $22.20 million.

It is anticipated that the filter rehabilitation project will get started in 2012 or 2013. The last filter rehabilitation project was initiated about 25 years ago, so another upgrade to the filtration system will be needed during the 40-year planning period. Rather than including costs for another rehabilitation of the sand filters, order of magnitude costs for membrane filtration will be used in the CIP. Membrane filtration is becoming a common technology to treat potable drinking water due to development of lower cost membranes with improved performance characteristics. The use of membrane filtration technology is expected to increase in the future and replace traditional water treatment technologies. Membranes offer numerous benefits for potable water production when compared to conventional treatment methods. Membrane filtration systems are reliable and can consistently produce very high quality filtered water due to the small pore size of the membrane media. Membrane filters can remove microorganisms such as protozoa, bacteria and viruses because the pore size of the membrane is much smaller than these

microorganisms. Membranes can completely remove chlorine-resistant pathogenic protozoan cysts and oocysts of Cryptosporidium and Giardia. The effective removal of these microorganisms makes the water very safe for consumption. Finally, membrane filtration systems have lower chemical requirements than conventional water treatment technologies. Membranes can remove suspended solids without the need for chemicals and chemical consumption required for disinfection (especially chlorine) will be substantially reduced since most microorganisms will be removed at the filtration stage.

Two studies on rehabilitation of the clearwell were completed in 2008. As discussed under Task 3.3, the clearwell has not been rehabilitated since it was constructed in 1908. Estimated project costs for the HDR and Malcolm Pirnie recommended alternatives are virtually identical, so an estimated construction cost of $52.817 million will be used for improvements to the clearwell. The clearwell alternative recommended by Malcolm Pirnie includes construction of a UV disinfection facility.

A prioritized set of water filtration plant improvements can be found in Task 4.11. The information presented under this task includes concept level cost estimates and schedules for future recommended capital improvements. .

Anticipated Future Changes to Safe Drinking Water Act Regulations

Ongoing PWSA efforts to reduce TTHMs are discussed under Task 3.3. PWSA has optimized performance of the water treatment plant to reduce TTHM formation and is taking additional steps at storage tank locations to reduce TTHMs in the distribution system. Anticipated future changes to Safe Drinking Water Act regulations are summarized below.

Revisions to the Total Coliform Rule

Coliforms are naturally occurring bacteria that are used as an indicator that other, potentially dangerous bacteria may also be present. The presence of E. coli may indicate potential contamination by harmful bacteria that can cause symptoms such as nausea, headaches, cramps, and diarrhea.

Proposed revisions to the Total Coliform Rule were published in July 2010. The proposed revision document identified monitoring requirements for systems with greater than 1,000 customers and defined what constitutes a violation of the E. Coli maximum contaminant level (MCL). It also identified the trigger points for Level 1 and Level 2 assessments of E. coli MCL violations. A Final Revised Total Coliform Rule is scheduled to be released in 2012.

Hexavalent Chromium

Chromium is a metallic element that is found in rocks, plants, and soil. The most common forms of chromium in the environment are trivalent (chromium-3), hexavalent (chromium-6) and the metal form (chromium-0). Chromium-3 is an essential human dietary nutrient that is found naturally at low concentrations in foods such as vegetables, grains, fruits, and meats. Chromium-6 is a more-toxic form that is generally produced by industrial processes. National primary drinking water regulations require community and non-transient, non-community water systems to test for chromium at the entry point to the distribution system.

The United States Environmental Protection Agency (EPA) regulates chromium-6 or hexavalent chromium as part of the total chromium drinking water standard. Chromium-6 and chromium-3 can convert back and forth, depending on environmental conditions, and measuring just one form may not capture all the chromium that is present. In order to ensure that the greatest potential risk is addressed, EPA's regulation assumes that the sample is 100% chromium-6, the more toxic form. The current maximum contaminant level for total chromium in drinking water is 100 parts per billion.

New health effects information has become available since the original drinking water standard was set in 1992. Based on a September 2010 draft human health assessment, EPA is proposing to classify hexavalent chromium as likely to cause cancer in humans. The draft health assessment addresses both non-cancer and cancer health effects associated with the ingestion of chromium-6 over a lifetime. This is the first EPA cancer assessment for hexavalent chromium by ingestion. The EPA classified hexavalent chromium as a known human carcinogen via inhalation in 1998 but did not have the science at that time to be able to classify it as a carcinogen via ingestion. When the review is complete, the EPA will consider this and other information to decide whether the drinking water standard for total chromium needs to be updated.

Perchlorate

Ammonium perchlorate is the oxidant in solid rocket fuel and is an essential component of military explosives, bottle rockets, fireworks, highway flares, and black powder. Much of the perchlorate contamination is believed to have seeped into ground waters around missile test sites and chemical manufacturing or storage facilities. However, recent research indicates that perchlorate may be formed naturally, most likely by photochemical reactions in the atmosphere. Perchlorate inhibits iodine uptake by preventing the thyroid gland from absorbing iodine from the bloodstream.

A 2008 determination not to regulate perchlorate was reopened after the EPA found there was a significant likelihood that perchlorate will occur in public water systems with a frequency and at levels of public health concern. The EPA's final regulatory determination is expected in 2011. The likely range for the proposed perchlorate MCL is 2 to 23 parts per billion (ppb).

Lead and Copper

The presence of lead and copper in drinking water is mostly due to corrosion of plumbing materials in potable water piping systems. The goal of the lead and copper rule is to minimize levels of these metals in drinking water, primarily by reducing water corrosivity. The rule establishes action levels of 0.015 milligram per liter (mg/l) for lead and 1.30 mg/l for copper based on 90th percentile levels of tap water samples. An action level exceedance is not a violation but can trigger other requirements that include water quality parameter monitoring, corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement. All community water systems and non-transient, non-community water systems are subject to the lead and copper rule requirements.

Exposure to lead can cause damage to the brain, red blood cells, and the kidneys, especially in young children and pregnant women. Lead can cause high blood pressure and delays in physical/mental development in children. Copper exposure can cause stomach and intestinal distress, liver or kidney damage, and complications of Wilson's disease in genetically predisposed people.

Changes to the lead and copper rule are expected to include changes to flushing guidance and sample collection after service line replacement, guidelines for lead service line replacement programs, changes to sample site collection criteria, guidance on new corrosion control strategies, and discussion of issues related to tap sampling. Revisions to the lead and copper rule are planned for 2012.

Groups of Contaminants

In March 2010, the EPA Administrator released a new drinking water strategy that includes regulating contaminants as groups rather than individually as has been done in the past. This approach will promote the use of new technologies for monitoring and treatment while leveraging the use of existing statutes to protect water sources. The new strategy will also promote easy access to utility monitoring data.

A total of nine contaminant groups have been identified by the EPA. The three contaminant groups that are ready for initial consideration include nitrosamines, carcinogenic volatile organic chemicals, and disinfection by-products from chlorination. One group is expected to be selected for regulation in 2011.

The EPA believes it has enough information to make a decision for the three categories listed above but needs more data for the other six groups, which are listed below:

- Perfluorinated compounds (PCFs).
- Organophosphates.
- Carbamates.
- Triazines.
- Chloracetanilides.
- Cyanotoxins.

4.4 CAPACITY IMPROVEMENTS

Current and Future Water Demands

Current and projected future water demands were presented under Task 3.4. Future water demands were based upon SPC Cycle 8 population projections for the existing PWSA water service area, including current water for resale customers. Existing and estimated future water requirements from Task 3.4 are summarized below.

Description	Average Day (mgd)	Maximum Day (mgd)
Existing Water Demand	70.2	107.0
2051 Water Demand	75.9	116.0

Water Supply and Treatment Capacities

A web site hosted by the Pennsylvania Department of Environmental Protection (http://www.drinkingwater.state.pa.us/default.html) provides information on drinking water systems in Pennsylvania. Information from this site shows that PWSA has a 100 mgd water allocation and the Aspinwall water treatment plant has a 117 mgd design capacity.

The existing 70.2 mgd average day water demand represents 60 percent of the 117 mgd design capacity and 70 percent of the 100 mgd water allocation. Future water demands in 2051 are expected to increase to 65 percent of the design capacity and 76 percent of the water allocation. Current and projected maximum day demands are less than the 117 mgd plant design capacity but exceed the current 100 mgd water allocation.

Task 2.3 analyzed Allegheny County public water providers to identify potential expansion areas for the PWSA water system. This review indicated that future expansion of the PWSA service area is limited by practical considerations to a pair of neighboring

communities (Etna and Sharpsburg) and to the portion of the City that is currently served by Pennsylvania American Water Company.

If Etna and Sharpsburg were to become PWSA customers in the future, water could be provided to these communities through existing interconnects with the PWSA system. The total average day demand is about 0.60 mgd and the combined maximum day demand is estimated at 0.90 mgd. Providing service to these municipalities would have little to no effect on average day or maximum day system demands.

An estimated 20,304 water customers in the City are currently served by Pennsylvania American Water. These customers have a 6.84 mgd average day water demand and an estimated 10.95 mgd maximum day demand when "unaccounted for" and "other" water demands are added to the average metered usage. Providing water to this area would increase the average day PWSA system demand to about 77 mgd and could at times cause maximum day demands to exceed the permitted 117 mgd permitted capacity of the Aspinwall water treatment plant. However, PWSA has over 400 million gallons of storage capacity in the distribution system. Therefore, any maximum day demands in excess of the treatment plant capacity could be provided by stored water.

As discussed under Task 2.3, an estimated $68.60 million in system improvements would be required in order for PWSA to provide water service to customers in the portion of the City currently served by Pennsylvania American Water. The feasibility of extending service to this area was evaluated by comparing potential revenues from water sales to the debt service payments that would be needed to finance the estimated $68.60 million in system improvements. To simplify the analysis, the 4.11 mgd average daily metered water demand was divided evenly between the 20,304 customers and estimated revenue from water sales was based on the 2012 rate schedule for residential service.

The table below compares annual payments for a $68.60 million, 20-year loan to annual revenue from water sales. Revenue from water sales in this area would total about $9.80 million per year while annual loan payments to finance the system improvements would vary from $4.97 to $5.87 million, depending on the interest rate. Average municipal bond interest rates for 2012 are in the four percent range. The current PENNVEST interest rate for Allegheny County is 1.751 percent for the first period and 2.276 percent for the second period. However, PENNVEST loans are limited to $11 million for a single project.

Interest Rate (percent)	Annual Loan Payment	Revenue From Water Sales	Difference
3.00%	4,565,447	9,803,241	5,237,794
4.00%	4,988,430	9,803,241	4,814,811
5.00%	5,432,756	9,803,241	4,370,485

In order for the purchase of the PA American system within the City to make economic sense, the increase in water revenues has to exceed the sum of the annualized purchase price for the system plus any capital, operation and maintenance costs associated with ownership of the system. The cost history for the Millvale water system can be used to estimate capital, operation, and maintenance costs and allow development of a price for potential purchase of the system. If the initial economic evaluation is positive, discussions can be initiated with PA American regarding system acquisition by PWSA.

Recommended Water Allocation Permit Change

The table below presents information from recent PWSA Annual Water Supply Reports. This information shows that maximum daily water use averaged 95.25 mgd from 1996 to 2009 and exceeded the 100 mgd water allocation in four years.

Year	Average Daily Water Use (GPD)	Maximum Daily Water Use (GPD)	Minimum Daily Water Use (GPD)
1996	61,268,473	93,917,000	46,217,000
1997	58,465,233	84,136,000	13,375,000
1998	54,494,931	76,265,000	27,561,000
1999	63,164,164	**101,166,000**	25,708,000
2000	68,111,361	91,000,000	15,197,000
2001	69,580,934	**102,000,000**	18,542,000
2002	73,231,000	97,000,000	44,541,000
2003	74,110,000	**106,417,000**	38,583,000
2004	70,487,787	98,958,000	50,166,000
2005	72,449,789	99,170,000	25,633,000
2006	70,780,447	89,687,000	37,458,000
2007	75,763,177	**107,850,000**	14,856,000
2008	71,553,396	94,850,000	41,810,000
2009	70,068,158	91,048,000	26,715,000
Averages	68,109,204	95,247,429	30,454,429

Based on current and projected future water demands, it is recommended that PWSA apply for an increase in the permitted water allocation from 100 to 117 mgd.

4.5 BACK-UP POWER SUPPLY AND CLEARWELL CONCERNS

Backup Power Supplies to Critical Facilities

Net pumpage data provided by PWSA was reviewed and evaluated to rank in order of importance the critical facilities requiring backup power. The ranking was based upon the amount of water provided to each reservoir and water storage tank by the various

pump stations. The table below presents average net pumpage data for the three year period from 2007 to 2009.

Pump Station	Reservoir/Tank	Average Pumpage (mgd)	Percent of Total
Bruecken PS (Pumps 2 – 4)	Net Highland 1 Reservoir	12.89	19.7
Bruecken PS (Pumps 5 – 7)	Net Highland 2 Reservoir	8.43	12.9
Herron Hill PS (Pumps 1 – 5)	Net Herron Hill Reservoir	14.46	22.1
Aspinwall PS	Net Lanpher Reservoir	8.16	12.5
Howard PS (Pumps 1 – 4)	McNaugher Reservoir *	5.21	8.0
Mission PS	Allentown Tank	4.38	6.7
Howard PS (Pumps 5 – 7)	Brashear Tanks	3.08	4.7
Highland PS	Garfield Tank	2.74	4.2
Saline PS	Squirrel Hill Tank	2.29	3.5
Fox Chapel Pump Station	N/A	1.58	2.4
Lincoln PS	Lincoln Tank	0.98	1.5
Herron Hill PS (Pump 6)	Bedford Tank	0.70	1.1
Herron Hill Tank PS	Herron Hill Tank	0.43	0.7
Total Average Pumpage 2007 to 2009		65.34	100.0

* Includes Spring Hill Tank

The Bruecken pump station provides water to Highland 1 and 2 reservoirs and pumped 21.32 mgd or almost one third of the total water produced by PWSA. The Herron Hill pump station delivered 14.46 mgd to the Herron Hill reservoir on average, equivalent to about 22 percent of the total water produced by PWSA. The Aspinwall station pumped 8.16 mgd or 12.5 percent of the water in the PWSA system. These three stations pump more than two-thirds of the water in the PWSA system and qualify as critical facilities that require backup power.

A 90 percent design for standby power facilities at the Bruecken Pump Station was completed in June 2008. The estimated cost for the improvements was $6.98 million. Facilities are currently being installed at Bruecken to accommodate temporary hook-up of emergency generators while Highland No. 2 reservoir is out of service for installation of a replacement liner and floating cover. The electrical connections for emergency generators at Bruecken will remain in place after the Highland No. 2 reservoir cover project is completed.

Due to the high cost for permanent standby power facilities at the Bruecken pump station, PWSA issued an advertisement in March 2012 for bids for a portable emergency generator to provide backup power at the water pump stations. The purchase contract is for a two megawatt (MW) power generator set consisting of two – 1,000 kW diesel generator sets in parallel. The 1,000 kW generator sets are housed in a 48-foot ISO container that is supported on a 48-foot air ride chassis. The unit has a 1,250 gallon double walled fuel tank and is rated for 2,000 kW at 0.80 PF. Bids were opened on April 17, 2012. Cummins Bridgeway, LLC submitted a bid price of $1,450,000 for the 2 MW Power Generator Set.

It is recommended that facilities be installed at the Aspinwall and Herron Hill pump stations to allow the portable generator to be hooked up to provide emergency power. The 2 MW generator for which PWSA recently received bids has sufficient capacity to provide emergency power at either the Bruecken, Aspinwall, or Herron Hill pump stations. The portable generator is sized to power the largest pump in the PWSA system and can provide emergency power for one of the four 2,250 HP pumps at Bruecken. Alternatively, the generator could power one of the two 1,500 HP pumps or both of the 1,000 HP pumps at Aspinwall. The generator is large enough to power all of the pumps at the Herron Hill pump station.

Clearwell Rehabilitation/Replacement

The findings of the Clearwell Improvements Studies prepared by HDR and Malcolm Pirnie are presented under Task 3.3 and are summarized below.

The HDR study recommended that PWSA proceed with Alternative 1, construction of a permanent clearwell in an existing sedimentation basin. This option has a total estimated project cost of $68.574 million and includes the following components:

- Conversion of the central receiving basin to a finished water clearwell.
- Installation of a pump station and transmission main to convey filtered water to the new clearwell.
- Construction of a gravity line from the new clearwell back to the Aspinwall and Bruecken pump stations (will also serve as a bypass for the existing clearwell).
- Installation of variable speed drives on the Aspinwall and Bruecken pumps.
- Rehabilitation of the existing clearwell.
- Increased utilization of existing system storage at the Highland Reservoirs

The Malcolm Pirnie report identified Alternative 3c as the preferred option. This option includes rehabilitating the existing clearwell and installing a combined filter effluent

(CFE) UV system. This alternative has a total estimated project cost of $68.664 million and includes the following major items:

- Construction of a CFE UV Facility.
- Construction of a temporary equalization basin.
- Construction of finished water pump station VFDs and electrical modifications.
- Rehabilitation of the existing clearwell or demolition and construction of a new clearwell.
- Modifications to site piping at the water treatment plant

Estimated project costs for the recommended alternatives are within $90,000 of one another, so an estimated construction cost of $52.817 million will be included in the 40-Year Plan for improvements to the clearwell.

License to Pursue Hydropower

PWSA authorized Tetra Tech to conduct a feasibility review for a hydroelectric plant at the Allegheny Lock and Dam 2 (Highland Park). A preliminary review prepared in April 2012 indicates that a hydroelectric plant is feasible at this location. An installation with two 4 MW turbines would generate approximately 53 GWh/year, which is close to the amount of electricity used by PWSA on an annual basis. The cost analysis contained in the feasibility review projected that annual revenues from power sales would exceed the annual debt service and O&M costs for the hydroelectric facility.

Per Federal Energy Regulatory Commission (FERC) regulations, a permit is needed to develop a hydroelectric project. Free Flow Power (FFP) Missouri 12, LLC is the holder of the Preliminary Permit to investigate the development of a hydroelectric project at the Allegheny Lock and Dam 2. A hydropower project could be developed in conjunction with FFP or PWSA could purchase the rights to the permit from FFP and develop its own project. If a joint project were developed with FFP, project related costs and revenues would be shared by the two parties. PWSA would have to make a monetary payment to FFP to purchase the rights to the permit. Either of these arrangements would affect the cost projections contained in the feasibility review. Therefore, PWSA will need to re-evaluate the financial feasibility of the project based on the results of any future discussions with FFP.

Capital Improvements

Recommended capital improvements are presented under Task 4.11.

4.6 RISK BASED MODEL

It is recommended that CapPlan be used by the PWSA to update the CIP as water main replacement projects are completed.

When the GIS is updated to reflect changes to the system, old high-risk pipes will be eliminated and replaced with new, low-risk pipes. Prior to finalizing specific elements for each year's capital program, the results of the CapPlan analysis should be reviewed and adjusted as necessary to consider anticipated redevelopment projects that will result in the replacement of mains as part of the redevelopment activities and to incorporate special needs and input provided by the operations and engineering staff. Periodically, the CapPlan analysis should be repeated to update the CIP project list. Similarly, the analysis can be repeated to reselect prioritized CIP projects if there are changes in the available capital budget.

4.7 LEAK DETECTION AND REPAIR

Non-Revenue Water Analysis

An analysis of historic water usage and population was conducted to assess the level of non-revenue water in the PWSA system. Figure 4-18 compares the population of the City of Pittsburgh to the amount of water delivered to the system between 1950 and 2009. Reduced water deliveries generally paralleled population decreases from 1950 through the early 1980's. The city's population continued to decline since that time but the amount of water delivered to the system has increased. Average water demands rose from 56 mgd in 1982 to 70 mgd in 2009, an increase of about 25 percent, while the city's population decreased by an equal percentage. The divergence of population and water demand indicates that the amount of non-revenue water in the PWSA system has increased over the past 30 years.

Table 4-2 presents average daily water usage information from PWSA Annual Water Supply Reports for the period from 1996 to 2009. Data is presented for individual customer classes and usage categories. Average daily water use includes domestic, commercial, industrial, institutional, and bulk sales to other public water suppliers. It also includes the unaccounted for and other water categories. Other is defined as water for public and municipal uses, hydrant inspections, hydrant flushing, street flushing, government usage, plant processing, etc. The information from Table 4-2 is presented graphically in Figure 4-19.

Information from the Annual Water Supply Reports shows that bulk water sales and usage by commercial and institutional customers remained relatively constant from 1996 to 2009, while estimated domestic unmetered sales doubled. Industrial usage declined slightly and domestic metered sales dropped by almost two thirds, decreasing from 31 mgd to 11 mgd. Overall water use went up by about 15 percent as compared to the 1996

Figure 4-18
City Population Versus Water Delivered to System, 1950 to 2009

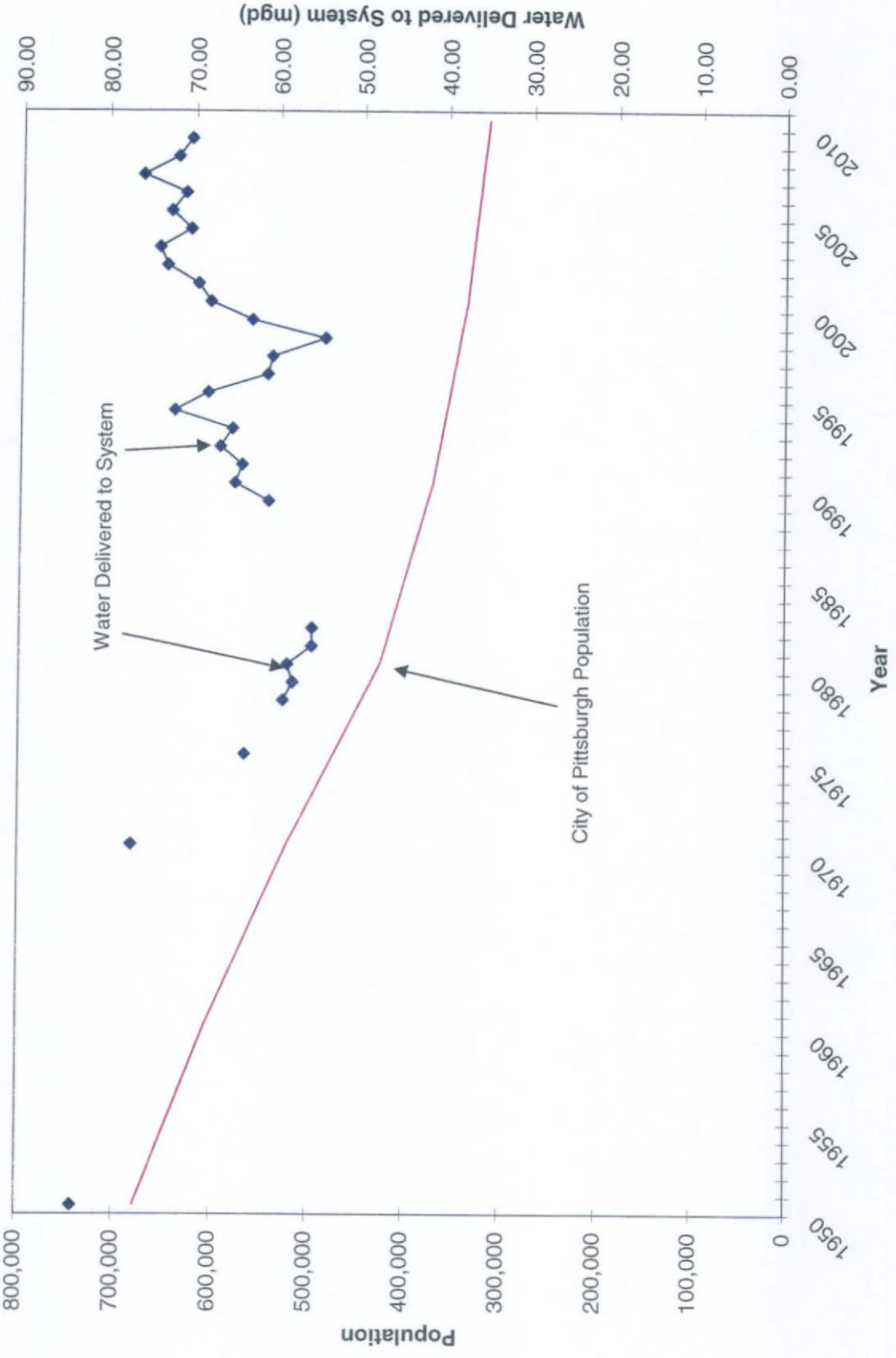
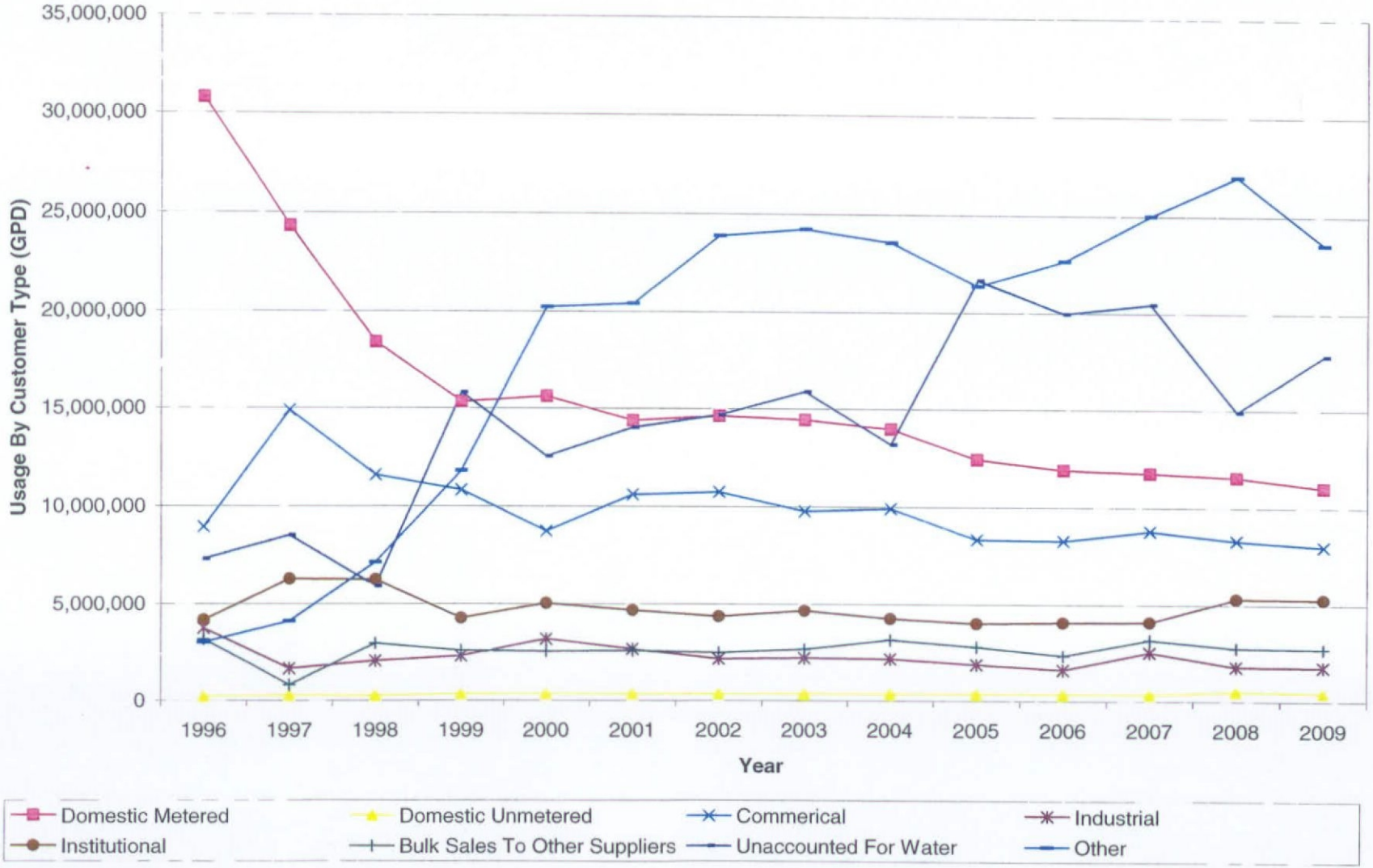


Table 4-2

PWSA Average Daily Water Usage by Customer Type (Gallons per Day)

Year	Domestic Metered	Domestic Unmetered	Commercial	Industrial	Institutional	Bulk Sales	Unaccounted For Water	Other	Total
1996	30,749,945	207,860	8,948,052	3,722,036	4,151,210	3,183,977	7,294,649	3,010,744	61,268,473
1997	24,286,221	252,790	14,879,784	1,619,731	6,255,665	808,120	8,505,712	4,105,870	60,713,893
1998	18,391,257	236,500	11,603,795	2,028,591	6,225,791	2,967,641	5,911,358	7,129,998	54,494,931
1999	15,295,000	331,700	10,832,000	2,274,000	4,245,000	2,586,000	15,791,000	11,810,000	63,164,700
2000	15,586,021	330,000	8,725,859	3,163,070	5,017,664	2,539,008	12,532,602	20,217,137	68,111,361
2001	14,347,775	336,640	10,605,041	2,646,986	4,649,126	2,579,049	14,012,127	20,404,190	69,580,934
2002	14,605,805	336,640	10,752,762	2,129,252	4,341,403	2,479,863	14,687,325	23,897,950	73,231,000
2003	14,407,194	353,200	9,773,890	2,173,753	4,635,630	2,656,252	15,880,081	24,230,000	74,110,000
2004	13,945,259	350,400	9,923,035	2,130,666	4,235,532	3,152,000	13,175,895	23,575,000	70,487,787
2005	12,423,912	347,600	8,344,151	1,855,244	3,992,559	2,788,762	21,675,158	21,370,000	72,797,386
2006	11,889,132	352,000	8,294,030	1,576,236	4,048,288	2,329,071	19,961,690	22,682,000	71,132,447
2007	11,748,967	339,200	8,795,466	2,495,419	4,077,397	3,165,008	20,465,920	25,015,000	76,102,377
2008	11,539,609	490,000	8,313,612	1,754,855	5,299,522	2,753,672	14,913,672	26,978,454	72,043,396
2009	11,015,712	425,000	8,006,317	1,732,279	5,258,852	2,700,849	17,812,591	23,541,558	70,493,158

Figure 4-19
Average Daily Water Use by Customer Type



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total. The increase in total usage was accompanied by increases in the unaccounted for and other usage categories. Metered water usage represented about 83 percent of the total water produced in 1996. By 2001, metered usage was comparable to the sum of the unaccounted for and other usage categories. In 2009, metered usage was about 41 percent of the total water produced and unaccounted for / other usage was 59 percent.

Part of the increase in the unaccounted for and other water usage categories can be attributed to metering inaccuracies. A draft water audit was prepared to examine the accuracy of the primary meters that measure the amount of water produced and pumped through the PWSA system. The findings of the water audit are summarized in the following section.

Water meters are installed at individual customer locations to measure the amount of water consumed for billing purposes. However, water meters are mechanical devices that slow down and under-report the actual amount of water flow as they age. As the meter accuracy drops, the utility receives less revenue from water sales. In the past, AWWA recommended a replacement interval of 7-10 years for water meters, with some allowance depending on environmental factors. With recent advances in water meter technology and construction, the recommended replacement interval has been increased to 15-20 years for new meters.

PWSA provided the following age summary information for customer water meters 1-inch and smaller.

Meter Age In Years	Number of Meters	Percent of Total
1 to 8	17,709	22.8%
15 to 19	32,446	41.7%
20 to 25	27,286	35.1
> 26	339	0.4%
Total	77,780	100.0%

Based on the information above, a third of the existing customer water meters are more than 20 years old and three quarters are more than 15 years old.

It is recommended that a meter replacement program be instituted to replace all customer water meters that are more than 20 years old. The purpose of the replacement program is to increase revenues from domestic water sales. A nine-year program would be needed to replace the 60,071 meters that are currently 15 years or older. Approximately 6,900 meter replacements per year would be needed in years 1 through 4 to address the oldest meters in the system. Another 6,500 meters would have to be replaced annually in years 5 through 9 to replace meters that are currently in the 15 to 19 year age range. By the end of year 9, all of the domestic meters in the PWSA system would be less than 20 years old. Approximately 2,200 meters per year would then have to be replaced in years 13 to 20 to replace the meters that are currently in the 1 to 8 year age range. In year 21, the meter

replacement cycle would start again. About 5,000 meter replacements would be needed in years 21 through 32, followed by 2,200 meter replacements in years 33 to 40.

Review of Draft Water Audit

A draft water audit study was prepared by HDR Engineering, Inc. The intent of the audit was to check the accuracy of the primary meters in the PWSA system and to quantify system-wide non-revenue water. The water audit was reviewed as the starting point for development of a comprehensive leak detection and repair program.

Table 4-3 summarizes the results of the draft water audit. The raw water meter at the Ross pump station and the meters on rising mains 1 and 2 at the Bruecken pump station were not tested. However, 17 venturi meters in the PWSA water system were tested using pitot tube measurements. Pitot tube readings were recorded over a 24-hour period, and then the results were compared to venturi meter readings for the same time period. Field measured flow is the average flow measured during the pitot tube tests while the SCADA metered flow represents the meter output produced by the existing metering equipment during the pitot test. Meter accuracy is the ratio of metered flow to measured flow. If meter accuracy is less than 100%, the existing metering equipment is under recording the amount of flow. Meters with accuracies greater than 100% are over recording the amount of flow. Table 4-3 lists meters from most accurate at the top to least accurate at the bottom. Meter accuracies vary from a high of 99.8 percent to a low of 166.7 percent.

The American Water Works Association (AWWA) Manual M6 (Water Meters - Selection, Installation, Testing, and Maintenance) has established that a venturi meter must have a minimum accuracy of 98 percent to be considered accurate. The status column in Table 4-3 identifies the venturi meters that meet this standard. Only 2 of the 17 meters tested meet the AWWA accuracy requirement. The most accurate meter is located at the Herron Hill pump station and the second most accurate meter is situated at the Mission pump station. Six other meters register flows that are within 5 to 10 percent of the pitot measured values, but more than half of the meters have recording inaccuracies greater than 10 percent.

It is recommended that testing and maintenance procedures be established to assure meter accuracy. Accurate measurement is needed so that the amount of water pumped to the distribution system can be compared to metered water usage by PWSA customers. Meters at the treatment plant, and elsewhere in the system that measure the largest water volumes should be the highest priority in the meter testing and maintenance program. These meters determine how much water is produced and should be tested at least once a year. Industrial and commercial meters are the second testing and maintenance priority in the system because large volume users provide considerably more revenue per meter. For residential customers, a meter change-out program should be instituted so that PWSA maintains a 20 year meter replacement cycle.

Table 4-3

Summary of Draft Water Audit Results

Task	Venturi Meter Name	Meter Size (inches)	Venturi Meter Number	Test Date	Field Measured Flow (mgd)	SCADA Metered Flow (mgd)	Meter Accuracy	Status
A	Ross (Raw Water)	48	499	N/A	N/A	N/A	N/A	N/A
A	Bruecken - Riser Main 1	48	15960	N/A	N/A	N/A	N/A	N/A
A	Bruecken - Riser Main 2	48	15961	N/A	N/A	N/A	N/A	N/A
B	Herron Hill Pump 5	20	F17	12/12/2007	0.628	0.627	**99.8%**	Pass
B	Mission Pumps 4 & 5	24	N/A	12/14/2007	12.790	12.630	**98.7%**	Pass
B	Howard Pumps 1 - 4	20	F12	12/13/2007	7.890	8.260	104.7%	Fail
B	Saline Pumps 1 - 3	20	16880	12/12/2007	0.184	0.175	95.1%	Fail
A	Aspinwall - Riser 1 & 4	36	33525	6/27/2006	14.140	14.900	105.4%	Fail
B	Howard Pumps 5 - 7	24	F14	12/13/2007	4.480	4.730	105.6%	Fail
A	Aspinwall - Riser 2 & 3	36	33526	12/10/2007	17.060	18.190	106.6%	Fail
A	Bruecken - Riser Main 3	48	15962	12/13/2007	15.430	14.030	90.9%	Fail
B	Mission Pumps 1 - 3	24	33119	1/22/2009	12.220	10.760	88.1%	Fail
B	Herron Hill Pump 6	12	F18	12/12/2007	3.010	2.630	87.4%	Fail
B	Herron Hill Pumps 2 & 4	20	F19	12/12/2007	5.110	4.370	85.5%	Fail
B	Herron Hill Tank	12	F21	12/14/2007	1.260	0.960	76.2%	Fail
B	Lincoln	20	F15	12/14/2007	1.890	2.420	128.0%	Fail
A	WTP - Filter Composite	96	N/A	1/20/2009	78.960	56.580	71.7%	Fail
A	Bruecken - Riser Main 4	48	18284	12/13/2007	21.220	13.610	64.1%	Fail
B	Herron Hill Pumps 1 & 3	20	F20	12/11/2007	5.430	3.860	71.1%	Fail
B	New Highland Pumps 1 - 3	20	F16	12/10/2007	1.680	2.800	166.7%	Fail

Required Meter Accuary per AWWA is + / - 2 %

PWSA SCADA System Upgrade Project

PWSA issued an RFP for a SCADA system upgrade project in January 2010. The scope of work covered detailed design for upgrades to the SCADA systems at the Water Treatment Plant, pumping stations and water storage sites including the chlorine booster stations and flow meter vaults. The primary goals of the project are to upgrade the SCADA technology utilizing non-proprietary components, standardize equipment and establish an open-architecture SCADA network. The project also includes an instrumentation survey and instrument replacement, if required. Details of the upgrade project are summarized below.

Water Treatment Plant

Work at the Water Treatment Plant will include design of a redundant fiber-optic ring to act as the communication backbone. The ring will be installed throughout the Water Treatment Plant and will connect the two operation centers located at the Operations Center Building (Main OC) and the Chemical Center (Chemical OC) so all information is available at both areas. The Main OC will be designed with a UPS back-up system to allow monitoring and control of treatment processes and pumping to continue for 60 minutes during power outages. The Chemical OC will be designed to be connected to the stand-by generator located in the Ross Pump Station. The project will also automate the lime process for pH control. Alarm systems will be designed to be shown on an Operators cell phone and the Operator will be notified of an event by a text message and/or ringing the cell phone.

Pump Stations

The Transmitton Remote Terminal Units (RTUs) that control the pump stations and monitor the storage sites will be replaced with RTU's of modern design. The project will integrate the SCADA system with PWSA CMMS to capture information including pump and motor hours, bearing temperature and vibration data and power outages. The tone telemetry equipment at each sewage pump station will be replaced with new RTUs. In addition to the parameters already monitored at the sewage pump stations, the new SCADA system will include wet well level, influent and effluent flow.

Reservoir and Tank Sites

Information from water storage locations is currently sent back to the respective pumping station and conveyed from there to the plant. A redundant communication link will be established for each storage facility site to the plant. Design will include replacement of all PLCs with more modern equipment. The

scope will include the design for transmitting the chlorine residual signal generated at each chlorine booster station to the SCADA System for monitoring at the Main OC. Chlorine analyzers are currently present at the Allentown, Squirrel Hill and Lincoln Stations, so the project will include installation of chlorine analyzers at the remaining stations. Work will also include the revival of the flow monitoring vaults located at various reservoirs and tanks. Different flow metering technology will be proposed and tested to assure accuracy before this activity proceeds. All flow data will be sent to the Main OC.

Membrane Filtration Plant

The membrane plant is currently isolated from the existing SCADA system network. A reliable and redundant communications link back to the Aspinwall WTP will be established so that the system can be monitored. A more reliable communications system will be designed to replace the existing radio connection.

Security

Design of the new SCADA system will include the following security measures:

- Door limit switches at pump stations to signal an intruder alert at the Main OC
- Security cameras at the Water Treatment Plant and water storage sites
- Automatic gate and camera set-up at the Water Treatment Plant
- Security video monitor located in the Main OC
- Consultant to develop separate costs for a security system to be added onto the overall project.

The SCADA system upgrade project will give PWSA the tools needed to investigate and reduce non-revenue water losses. Revival of the flow metering vaults at the reservoir and tank locations, along with improved flow metering and data collection abilities, will allow water use in individual service districts to be monitored and compared to metered customer usage. This will facilitate identification of the service districts with the highest levels of non-revenue water and allow further water loss investigations to be undertaken.

Non-Revenue Water Loss Ranking by District

As part of the 40-Year Plan, we intended to review available SCADA data and water billing records to initially rank service districts in terms of non-revenue and apparent water losses. Pumpage data by district for the period from 2007 to 2009 was obtained from PWSA for this analysis. However, it became apparent after reviewing the results of

the draft water audit that such an investigation would have little value due to metering inaccuracies on the supply side. The venturi meters on rising mains 1 and 2 from the Bruecken pump station were not tested, so the accuracies of these meters are not known. The meter on rising main 3, which conveys flow to Highland No. 1 reservoir, has an accuracy of about 91 percent. The meter on rising main 4, which carries water to Highland No. 2 reservoir, is only 64 percent accurate. Wide variations in meter accuracies at the secondary pump stations would make it impossible to draw any meaningful conclusions from comparisons of metered supply and demand.

The two meters that record flows from the Aspinwall pump station to the Lanpher reservoir have accuracies of 105.4 percent and 106.6 percent. Meters at the Howard pump station, which measure flows to McNaugher reservoir and the Brashear tanks, also have accuracies in the 105 to 106 percent range. Based on the similarity between meter accuracies, a reasonable analysis could be conducted for this portion of the distribution system by dividing the system into smaller subareas and comparing the amount of water supplied versus the metered customer demand. Areas with the largest supply to demand differential would have the highest apparent water loss. Unfortunately, water demand in this portion of the service area only represents 25 percent of total usage based on 2007 to 2009 pumpage records.

Leak Detection and Repair Strategies

When accurate metering data is available, a standard approach to a non-revenue water leak detection and repair program generally begins with a desktop review of the available water consumption and loss data. Comparisons of flow measurements and billed water consumption rates are used to rank subareas in the system from highest to lowest in terms of water losses. This work is followed by field activities in the areas determined to have the highest water losses. Field activities include active leakage control strategies such as leak detection surveys and taking flow measurements in designated system subareas.

Various methods are available for detecting water distribution system leaks. Most methods use sonic equipment that identifies the location of a leak based on the sound of water escaping from a pipe. These devices include pinpoint listening devices that make contact with valves and hydrants, as well as geophones that can be used directly on the ground. Correlator devices can also be used to pinpoint the location of a leak by listening simultaneously at two points. Leaks on river crossing pipelines are the most difficult to detect, so initial leak detection efforts should focus on river crossings.

Water from large volume leaks often reaches the ground surface. This allows large leaks to be found and repaired quickly. As a result, large leaks do not necessarily result in the greatest volume of lost water. Small leaks can result in larger quantities of lost water if they exist for a long time without being detected. In many situations, small leaks are easier to detect because they are noisier and easier to hear using hydrophones. Leak detection and repair activities generally produce an immediate reduction in water losses.

Pipeline replacement projects have longer-lasting impacts, to the extent that they eliminate the root cause of leaks. A decision to emphasize detection and repair over pipe replacement will depend upon site-specific leakage rates and costs.

Active leak detection is crucial in identifying unreported water leakage and losses in the distribution system. Without a leak detection program, leaks may only be found when they become visible at the surface or when major infrastructure collapses. Active leak control will reduce emergency overtime repair expenses, associated liability costs, the impact on customers, and possible impacts on roads, sewers, and other utilities. Leak detection must be immediately followed by leak repair, the more costly step in the process. However, the savings from reduced water losses outweighs the costs for leak detection and repair activities.

The most important part of a leak detection and repair program is maintaining accurate and detailed records. The information should be easy to analyze and the data format should remain consistent over time. Water systems should keep and maintain the following three sets of records:

- Monthly reports on unaccounted-for water
- Leak repair report forms
- Updated system maps showing the location, type, and class of each leak.

Wachs Water Services Contract

PWSA contracted with Wachs Water Services (WWS) to undertake a Large Diameter Valve Condition Assessment, Improvement and Information Management Program. The program began in November 2010 and focused on mapping the exact location of water main valves; inspecting, operating, and assessing the mechanical condition and operational reliability of the valves; and making necessary repairs to non-functional valves. WWS field crews inspected and operated or attempted to operate 3,336 selected valves in the PWSA service area. The valves ranged from 3 to 60-inches, with two-thirds of the valves being 12-inch in size. Each of the selected valves was exercised either fully or partially. After taking corrective actions that included minor repairs, the results of the program are summarized below:

Total Valves Visited:	3,336	
Overall Valve Condition:		
Good:	2,197	66%
Fair:	126	4%
Poor:	48	1%
Inoperable:	678	20%
Unknown:	259	8%
Not Applicable:	28	1%

Summary Information:

Cannot Locate	453	Main Valve Position Corrected	43
Covered Over	27	Vacuumed/pumped	525
Frozen	18	Not on Map	35
Sheared Stem	10	Conflict turn/size	88
Spins Free	46	Leaks when exercised	64
Op Nut Problem	83	Other Discrepancy	57
Structure Misaligned	6	Structure Damaged	19
Lid Replacements	324	Bypass Inoperable	61
Broken Gears	3		

It should be noted that 453 of the valves in the "inoperable" category could not be located.

The operational improvements resulting from this program will allow faster water pipeline shut-downs during water main breaks, which will limit damages to buried infrastructure and reduce the number of residents affected by water main breaks. The program will also minimize treated water losses associated with main breaks and reduce insurance and legal claims. This project ties directly into the Authority's commitment to reduce losses of unaccounted for water and proactively maintain vital fixed assets.

In-House Leak Detection Resources

PWSA has been operating a leak detection and repair program for approximately 25 years. Two crews and two trucks are normally engaged in leak detection activities on a full-time basis. One PWSA leak detection crew can survey between 1,500 and 2,000 feet of waterline per day.

Available leak detection equipment includes geophones, electronic leak detectors, electronic leak correlators, software, and computers. Correlating loggers are also used to identify leaks. Loggers are placed on valves or pipe fittings during the day and are left in place to perform surveillance overnight. After the loggers are retrieved the next day, signal processing software is used to pinpoint leak locations.

PWSA leak detection staff checks for leaks when problems are reported by residents or PWSA work crews. While investigating reported problems, the leak detection crews also check other waterlines in the vicinity for leaks. Much of their work is focused in areas like Garfield and Herron Hill that experience a high incidence of water leaks. As would be expected, many of the leaks occur in portions of the system with higher operating pressures. Leak information is currently not recorded in the PWSA GIS but a water leak database is maintained and monthly reports of leak detection activities are prepared. Report information includes the length of pipeline surveyed, street address, number of leaks detected, estimated leak rate, leak size, and neighborhood. Information on

identified leaks is forwarded to another PWSA department that is responsible for repairing the leaks.

PWSA leak detection staff has determined from testing activities that the discharge lines from pump stations are in good shape. This is likely due to the relatively constant pressures to which these pipelines are exposed. Lines that are subject to larger pressure variations tend to experience more leaks. They have also found that it's difficult to find leaks in water lines that are greater than 16-inches in diameter. Large pipelines tend to have fewer valves and hydrants, which are typically used as contact points for leak testing purposes. As a result, it is often necessary to drill down through the ground to establish contact points on larger lines. The other problem is that differences in acoustics make it harder to identify leaks on large lines. It is much easier to hear leaks on smaller lines.

Estimated Levels of Effort for Leak Detection Program

As noted earlier in this section, the experience of PWSA leak detection staff is that it is difficult to find leaks in pipelines larger than 16-inches in diameter. Therefore, this would appear to be a logical cut-off point for dividing responsibilities between in-house resources and outside contractor leak detection specialists.

Data from the PWSA GIS shows that the water system contains 5.34 million feet or 1,012 miles of waterlines ranging from 1 to 120 inches in diameter. Approximately 88 percent or 4.69 million feet of waterlines in the PWSA system are 16-inches in diameter or smaller. Based on the metric that one PWSA leak detection crew can survey between 1,500 and 2,000 feet of waterline in a day, two crews could survey all the 16-inch and smaller diameter pipe in the system within a 5 to 7 year period. This analysis assumes that 45 weeks per year are spent on leak detection activities. If the estimated 537,000 feet of pipelines that have been installed or replaced within the last 20 years are excluded from the total, the time required for a full survey would drop to between 4.6 and 6 years.

State regulatory agencies in the United States recommend that water systems should conduct complete system-wide leak detection surveys every 3 to 5 years unless leakage constitutes a small portion of unaccounted for water. The estimated time for PWSA forces to conduct a complete system survey is slightly above this range but Pennsylvania does not make any specific recommendations regarding leak detection efforts. The DEP recommends the AWWA standard of 10-15 percent for unaccounted for water but also notes the relevance of factors that can cause the percentage of unaccounted for water to increase such as system age, system condition, system pressure, customer density, and meter accuracy. The DEP also recommends that water systems calculate the cost of producing water and then determine the amount of money that is being "lost" due to unaccounted for water. If the loss from unaccounted for water is more than the cost of fixing the problem, then capital expenditures to reduce leakage can be justified.

Pure Technologies, Ltd. was contacted to obtain budget cost estimates for completing leak detection surveys on PWSA waterlines larger than 16-inches in size. This company offers two systems that allow live inspections of large diameter water mains. Both systems are capable of detecting leaks as small as ¼ gallon per hour at a pressure of 90 psi.

The Sahara Pipeline Inspection System is used to check for leaks while a pipe remains in service. A sensor is inserted into the main through a 2-inch diameter or larger tap. A small parachute uses the flow of water to move the sensor through the pipeline. The sensor can handle pressures up to 200 psi and is tethered to the surface via a cable. A surface tracking device allows the position of leaks to be located to within 18-inches. Two insertions can typically be completed in a day, which translates to a survey rate of 2,000 to 3,000 feet of pipeline per day. Over 1,000 miles of pipeline inspections have been completed using this system.

SmartBall is a foam ball with an instrument-filled aluminum alloy core. The ball can be inserted and retrieved from a pipeline under normal operation and travels with the water flow. Only two access points are needed into the pipeline, one at the insertion point and the second at the extraction location. Long battery life and large memory capacity allow the SmartBall to operate for up to fifteen hours, which permits long lengths of pipelines to be surveyed. At a flow velocity of 2 feet per second, the ball can travel about 18 miles in a single deployment. SmartBall's acoustic sensor can clearly discern the acoustic activity associated with leaks. Acoustic pulses emitted by the ball are picked up by receivers that are attached to pipe appurtenances. The locations of leaks relative to the receiver positions are determined by processing the recorded data and analyzing arrival times of the pulses. SmartBall can be used in transmission mains 10-inches and larger in size.

Pure Technologies, Ltd. provided cost estimates for provision of leak detection services. Estimates for both systems include a mobilization cost and a unit survey cost. The mobilization cost covers getting equipment and personnel to and from the survey location, as well as up-front costs for planning and engineering. Budget costs are as follows:

- Sahara $22,000 mobilization charge and $16,000 per day survey cost
- SmartBall $25,000 mobilization charge and $12,000 per mile survey cost

Mobilization charges are slightly less for Sahara but the SmartBall system is much less costly on a unit cost basis. The $16,000 per day survey cost for the Sahara system translates to a unit cost of about $33,800 per mile based on an average survey rate of 2,500 feet per day.

The PWSA system contains approximately 122 miles of pipelines that are larger than 16-inches in diameter. Excluding mobilization charges, leak detection with the SmartBall

system would cost an estimated $1.46 million and costs for the Sahara system are estimated at $4.12 million. Under Task 4.11, leak detection costs will include mobilization and will be spread over a multiple year period.

Recommendations for Instituting a Non-Revenue Water Leak Detection Program

The following activities are recommended for PWSA to institute a comprehensive and efficient leak detection program:

- Calibrate venturi meters at the treatment plant and pump stations to provide accurate figures for the amount of water produced and entering the distribution system.
- Break down the water system into subareas based on the locations of the venturi meters.
- Determine the total metered consumption in individual subareas.
- Compare the amount of water delivered to each subarea versus the amount of water consumed to determine apparent water losses.
- Rank the subareas from worst to best in terms of apparent water losses.
- Use leak detection contractors to find leaks in larger lines and PWSA crews to survey leaks in smaller lines.

Leak detection and repair efforts should focus on subareas identified as having the highest rates of apparent water losses to maximize results. The SCADA system upgrade will facilitate investigators by providing improved flow metering and data collection abilities.

The PWSA GIS can also be used to compare flow rates and metered usage to quantify non-revenue water losses on a near real-time basis. Most customer meters are equipped with an automatic meter reading feature that can be used to determine water use in 15 minute increments. If the water system subareas are broken down into smaller sections for further analysis, zonal system metering can be used in conjunction with automatic meter reading of customer usage to help determine leaks in the distribution system.

4.8 SEWER SYSTEM IMPROVEMENTS

The Draft Feasibility Study provides preliminary recommendations relative to projects designed to control CSO discharges from PWSA facilities. Although the recommendations are subject to change as the region's wet weather feasibility planning moves toward completion in 2012, the Draft Feasibility Study provides the best available indication of the improvements that will be required by the current COA deadline in 2026.

As discussed under Task 3.5, the improvements described in the Draft Feasibility Study were reviewed with PWSA staff to identify and refine the improvements needed to control overflows from CSO outfalls that are permitted to PWSA only. The improvements are sized to limit CSO discharge to four or fewer times during a typical year and, where necessary, provide sewers that are adequate to convey the peak flow from a 2-year design storm event to the ALCOSAN interceptor system. In cases where improvements are needed to sewers that receive flows from upstream communities, costs for the improvements will be shared between PWSA and the upstream communities.

Table 4-4 presents estimated project costs by sewershed for improvements needed to control overflows from PWSA permitted CSO outfalls. The figures shown in Table 4-4 represent preliminary estimates of PWSA's share of the overall project costs. Remaining costs are to be covered by capital contributions from tributary communities that use PWSA sewers to convey wastewater to the ALCOSAN system. PWSA's portion of the costs for individual projects range from $1.46 million in the Becks Run sewershed to more than $40 million in the Negley Run sewershed. Anticipated costs for half of the CSO projects are less than $10 million per job. Four other projects have estimated project costs in the range of $20 million to $30 million. PWSA's share of the total project cost for the CSO improvement projects is estimated to be $195.16 million.

The estimates in Table 4-4 are very preliminary estimates that are subject to change pending finalization of the PWSA Draft Feasibility Study and regional wet weather planning efforts. The estimates represent 2011 project costs that will be used under Task 4.11. Capital costs for CSO improvements will be distributed over a portion of the 40-year planning period based on the current 2026 deadline for COA related activities. Costs for projects scheduled for implementation in future years will be increased to account for inflation.

4.9 SEWER SYSTEM SURCHARGING

Sewer surcharging areas were identified by analyzing sewer backup data for the period from 2004 to 2010. Sewer complaint information from SAP records (Complaint Code 150 – investigate customer sewer backup and Complaint Code 180 – clear surcharging manhole) was tabulated and addresses were geolocated to determine the distribution of problem areas in the sewer system. Review of the data did not identify any discernable pattern of backups, so the reported causes and repair actions associated with the backups were also examined.

Review of available information showed that there was no specific cause for the backup and no repair noted for approximately 30% of the sewer complaints. For about 45% of the problems, repairs included cleaning, inspection, and miscellaneous repairs. In the remaining 25% of the cases, problems were reported to be associated with the customers' facilities. Based upon this analysis, the majority of reported problems seem to be localized and associated with the customer facilities. Although there may be some cases where a lack of downstream capacity is a problem, it is not possible to make specific

Table 4-4

Estimated Project Costs for PWSA CSO Improvements Required to Convey the Peak Flow From a 2-Year Design Storm (4 Overflows per Year)

Sewershed	Estimated PWSA Project Cost
Becks Run	$1,460,000
Bells Run	$21,310,000
East Street	$5,800,000
Little Saw Mill Run (Banksville Road)	$26,860,000
Lower Nine Mile Run	$25,480,000
McCartney Run	$6,100,000
McDonoughs Run (McNeily)	$17,100,000
Negley Run (Upper Nine Mile Run)	$40,100,000
Plummers Run	$29,150,000
Streets Run	$9,900,000
Weymans Run	$2,070,000
Brook Street, Englert Street, Brookline Blvd.	$9,830,000
TOTALS	$195,160,000

Costs represent the estimated PWSA share of sewer improvement project costs. The cost estimates are based upon a 0-overflow/typical year, 2-year design storm level of control. The costs assume an allocation of costs between affected municipalities computed based upon relative peak wet weather flow contributions.

determinations based upon the available information. It appears that sporadic surcharging occurs at various locations throughout the sewer system, primarily in response to high intensity storms and temporary obstructions.

In October 2011, the City of Pittsburgh issued a request for Stormwater Hydrologic / Hydraulic Modeling and Drainage Studies. The City requested professional services proposals from qualified engineering firms with experience in stormwater hydrologic/hydraulic modeling and drainage studies. The consultant's services will include conducting stormwater drainage analyses in areas of the City with identified flooding problems, starting with the Washington Boulevard area. The general scope of work for the project will be to analyze watersheds with identified flooding problems and model 2, 10, 25 and 100-year design storms to determine runoff rates and volumes, water surface profiles, channel velocities and inundated/affected areas. Detailed scopes of services will be developed for individual projects that the City elects to undertake. The contract for these services was subsequently transferred from the City to PWSA. In April 2012, PWSA awarded a contract to MS Consultants.

The analyses will describe the nature, extent and estimated cost of damages associated with potential flooding problems indicated by the modeling. Viable options for addressing existing flooding problems will be developed and issues associated with those options will be identified. Concept plans and cost estimates will be prepared for the identified alternatives. Written reports will also be prepared that detail the findings of the investigations, identify flood prone areas, and estimate the cost of flood damages versus estimated costs for alternative solutions. The reports will also provide analyses of the risk and the reduction of risk due to implementation of flood mitigation projects.

4.10 GREEN STORMWATER CONTROLS

Green stormwater infrastructure (GSI) may be a cost-effective element of a comprehensive wet weather flow management strategy in the PWSA service area. GSI measures can intercept stormwater runoff at or near its source, often at a lower cost per volume detained by storage facilities constructed farther downstream in the sewer shed. Further, some portion of the runoff intercepted by GSI facilities will never reach the combined sewer system; it will infiltrate into the ground. This aspect of GSI will avoid the cost of treating that portion of the captured runoff.

GSI measures may be installed on rooftops or at ground level. Rooftop GSI would be significantly more costly than ground level facilities, perhaps by more than a factor of ten. The following recommendations are based on ground level GSI.

Program administration cost estimates presented below are necessarily very general. They are offered more as comparisons among programs directed at the three sectors (residential, commercial / industrial / institutional, and public) than as absolute estimates. Personnel costs, which would dominate program administration, are based on $60,000

per work year, to include direct wages, payroll-related charges, and PWSA overhead. Financing costs are not included in these estimates.

Residential Sector

GSI in the residential sector would consist of small facilities aimed at controlling runoff discharges from individual residential rooftops. A rain garden of about 40 square feet would control the discharge from the roof of a typical urban residence. Small systems such as these should be standardized to a large extent as much as possible, to keep the residential program simple and cost-effective. However, the hilly nature of the PWSA service area terrain may require a significant amount of site adaptation.

Implementation Issues

PWSA could recruit homeowners through means already available for contacting customers, such as water and sewer bill enclosures, or separate mailings. Public service announcements on public and commercial television and radio stations could be used to raise awareness. Motivation could be provided by offering financing, either outright or through water and sewer charge abatement over a period of time.

Design and construction of residential GSI facilities should be overseen by PWSA or another public body formed for the purpose. This oversight is particularly important if public financing is involved, but should be considered for any residential program, to provide reasonable assurance that the facilities would function properly. Bad publicity caused by malfunctioning rain gardens would have a serious negative impact on a residential GSI program.

Funds for public financing of residential GSI projects would have to be recognized in utility accounting. These funds might be handled in a manner similar to the Act 129 program for electric power demand reduction: a surcharge on water and sewer service bills that is allocated to implementation of GSI projects. Another possible funding mechanism for residential GSI projects might be based on a property assessed clean energy (PACE) model. This approach provides funding to homeowners and places an obligation on the property owner to pay back the utility over a period of time, generally through a charge on the utility bill. A PACE-like obligation would remain in place with an ownership change.

Administrative Issues

PWSA would need to commit employee work effort to recruit and enroll homeowners and to set up and administer the approved designer and contractor program. The initial effort could probably be handled by one or two utility

employees, along with periodic assistance from other PWSA employees; ongoing administrative effort would depend on response from the residential sector.

Ongoing maintenance and long term functioning of residential GSI would present some difficult issues. A homeowner might decide to replace the rain garden with another kind of landscaping, or to neglect maintenance. Such actions – or inactions – would be difficult for the utility to detect. A program of periodic inspection would require the commitment of several employees, and identifying ineffective residential GSI facilities could be very difficult, as many malfunctions might occur beneath the ground surface or under the vegetative cover.

Responsibility for maintaining residential GSI facilities upon property transfer would present another difficult administrative issue. New authority may be required for a utility to extend maintenance responsibility to a new homeowner, or to implement a PACE-like funding mechanism. Further, the cost and problems of an ongoing inspection program would probably increase as residential properties change ownership.

Potential Program Costs

- Set up and initial recruiting effort – 3 work years $180,000
- Reviews, permits, inspections – 2 work years annually $120,000

Commercial/Industrial/Institutional Sector

GSI facilities in the commercial / industrial / institutional (CII) sector would generally be larger than residential facilities. They could be designed to intercept the runoff from building roofs and from paved areas such as parking lots, sidewalks, storage areas, and other hardscape. Design of these facilities would be site-specific, rather than standardized, to account for the many site variables involved.

Implementation Issues

PWSA might recruit CII owners using publicity programs similar to a residential program, but the effectiveness of such an approach might be limited, compared to the residential sector. Identifying CII owners willing to commit to building GSI facilities would probably require an approach that focuses attention on individual properties, with more up-front development work by PWSA to present possible GSI concepts to interest the property owner.

CII owners might be motivated to participate by public financing assistance or by abatement of water and sewer charges, or a combination of the two. Another approach might be offered by the formation of a public entity to regulate stormwater runoff flows based on impervious area. GSI might be offered as a means for a CII owner to reduce runoff volume or rate.

Decisions on designing and building GSI facilities should reside with CII owners. Many of these owners would be likely to have existing relationships with engineering and construction firms. PWSA should provide technical guidance and designs should be subject to approval prior to construction. Further, finished facilities should be inspected by PWSA to confirm their adherence to approved designs. Some CII owners may not have existing relationships with engineering and construction firms. PWSA might assist these owners by developing lists of such firms with demonstrated competence and providing these lists to CII owners.

Financing of GSI facilities in the CII sector might be provided by mechanisms borrowed from electric power demand reduction programs: Act 129 and PACE financing. Financing could also be left to CII owners, with water and sewer charge abatement offered to pay off capital costs over a period of time.

Administrative Issues

The administrative effort for a GSI program focused on the CII community would be significantly more demanding than a residential program. Recruiting participants would require more effort, due to the need to address site-specific factors and the need to establish a useful working relationship between PWSA and individual CII owners. Design and construction review and inspection would require individuals with more extensive training and experience, compared to a residential program. Further, since CII facilities would be larger than residential installations, they would merit more frequent and detailed inspection during their operational lives. The number of individuals required to administer a CII program would depend on the number of CII owners that decide to participate. Although it is not possible to compare work efforts for the residential and CII sectors explicitly, it is probably reasonable to estimate that the administrative cost related to each GSI installation would be three or four times greater in the CII sector, compared to the residential sector. However, facilities at CII properties would result in greater reduction of runoff than installations at residences.

The transfer of responsibility for operating the GSI facility, and for paying any financial obligation upon sale of a CII property would need to be assured.

Potential Program Costs

- Set up and initial recruiting effort – 4 work years $240,000
- Reviews, permits, inspections – 4 work years annually $240,000

Governmental Sector

The governmental sector, including public authorities, controls significant land area within the PWSA service area:

- City of Pittsburgh facilities, including streets, parks, public works shops.
- Allegheny County facilities.
- Port Authority of Allegheny County.
- Pittsburgh Public Schools.
- Pittsburgh Zoo.
- Sports and Exhibition Authority of Pittsburgh and Allegheny County.
- Pittsburgh Parking Authority.
- Urban Redevelopment Authority of Pittsburgh.
- Housing Authority of the City of Pittsburgh.

Of course, PWSA also owns land within the sewered area. PWSA and other public landowners control large areas of impervious surfaces that could be modified with GSI to decrease stormwater runoff and demonstrate to private sector property owners the benefits that could accrue by installing these stormwater management practices.

Implementation Issues

Government agencies and public authorities could be recruited by direct outreach from PWSA. A relatively small number of entities control a large amount of impervious area. Employees and governing board members of public authorities are probably fairly familiar with one another. Motivation might be financial – water and sewer fee abatements, for instance – and this motivation might be enhanced by the public service of providing a positive example to private sector property owners in the PWSA service area. GSI projects constructed on public sector land could also provide valuable opportunities for PWSA to monitor performance, yielding useful data to enhance understanding of how GSI facilities function in the Pittsburgh climate and topographic setting.

Design and construction of GSI facilities would best be left to the existing capital project practices of the government agencies and public authorities. Technical guidelines would be useful, and PWSA should be involved, particularly if a facility were to be identified for detailed performance monitoring.

Financing GSI projects at public sector sites could be provided through a centralized funding mechanism, or it could be left to each of the government agencies and public authorities to achieve through their respective funding processes.

Administrative Issues

Work tasks needed to administer a GSI program aimed at public sector owners would be similar to those needed for either the residential or CII sectors, but work effort would probably be significantly less for the public sector, compared to the other two types of owners. A relatively small group of owners, significant familiarity that already exists between PWSA and other public sector owners, and a generally positive disposition among public agencies and authorities toward actions that advance the public good would all work to decrease the effort needed to identify and implement GSI projects. PWSA or another designated public agency should provide technical guidance and oversight to the program.

A GSI program aimed at the public sector would offer good opportunities for PWSA to collaborate with higher education institutions. Carnegie Mellon University and the University of Pittsburgh both have engineering programs that would offer competent and relatively low cost teams to monitor and analyze GSI installations. Other higher education institutions with environmental programs might also be included.

Potential Program Costs

- Set up and initial recruiting effort – 1 work years $60,000
- Reviews, permits, inspections – 1 work years annually $60,000

Summary Recommendations

1. Do not expect a potable water conservation program to result in more than trivial reduction of wet weather flows to the PWSA sewer system.
2. Implement a GSI program that is focused on ground level facilities, considering rooftop measures for special cases.
3. Begin a GSI program on land owned by public sector agencies and authorities.
4. Monitor and analyze the public sector GSI installations to build a technical record to support further implementation.
5. Study administrative and financial structures to advance a GSI program into the private sector.
6. Consider the CII sector. Do not launch a program in the residential sector, but publicize the public sector experience to encourage homeowners to install GSI facilities voluntarily.
7. Develop site-adaptable plans for use by voluntary participants.
8. Consider developing a prequalification program for design and construction firms, which could be used by voluntary participants.

4.11 COST ESTIMATING - FIVE YEAR PLANS

This section presents concept level cost estimates and schedules for recommended capital improvements. Specific capital projects and anticipated capital expenditure levels throughout the 40-year planning period are identified. The improvement projects are broken down into eight- five year plans to provide the PWSA with a plan of action to meet business objectives, maintain regulatory compliance, and address operational needs within the framework of practical capital funding capabilities. The capital improvement projects are grouped according to business area: Distribution, Pumping and Storage, Treatment, and Sewers. In addition, costs for recommended capital improvements to the GIS system are presented.

Distribution

Table 4-5 presents concept level cost estimates for recommended capital improvements to the distribution system. Cost estimates were developed for the following projects:

- Replacement of pipe segments with medium to high risk of failure
- Leak detection on larger lines by outside contractor
- Water meter replacement program
- Millvale water system improvements to increase pressure
- Facilities to transfer water from Highland No. 2 District to Highland No. 1 District
- Bloomfield – Penn Avenue distribution system improvements
- Reduce size of Herron Hill Reservoir District
- Joint venture projects with the URA and other agencies

Replacement of pipe segments based on risk of failure was discussed under Task 4.2. Leak detection activities and meter replacement were presented under Task 4.7. The other projects were discussed under Task 4.1. An allowance of $1.50 million per year was included for joint venture water projects with the URA, PennDot, and other agencies.

Project cost estimates for the various activities include estimated construction costs plus a 25 percent construction contingency and a 15 percent allowance for project costs. The project cost estimates listed in Table 4-5 are based on 2011 price levels. For activities scheduled in future years, 2011 project cost estimates were increased by 3 percent per year. Both the Engineering News Record Construction Cost Index and the Consumer Price Index had average annual increases of about 3 percent for the 25-year period between 1985 and 2010. Over the 40-year planning period, the cost for recommended distribution system improvements is estimated to be $1.405 billion.

Table 4-5
Concept Level Cost Estimates for Recommended Capital Improvements - Distribution

Year	Replace Pipe Segments With Medium to High Risk of Failure	Leak Detection on Larger Lines by Outside Contractor	Water Meter Replacement Program	Millvale Water System Improvements to Increase Pressure	Highland 2 to Highland 1 Pump Station - Pipelines	Bloomfield - Penn Avenue Distribution System Improvements	Reduce Size of Herron Hill Reservoir District - Pipelines	Joint Venture Projects	Total
2012	$14,894,000	$388,000	$2,141,000	$721,000				1,545,000	$19,689,000
2013	15,341,000	400,000	2,205,000					1,591,000	19,537,000
2014	15,801,000	412,000	2,271,000		7,037,000			1,639,000	27,160,000
2015	16,275,000	424,000	2,340,000					1,688,000	20,727,000
2016	16,763,000	437,000	2,264,000					1,739,000	21,203,000
2017	18,675,000	450,000	2,332,000					1,791,000	23,248,000
2018	19,235,000	463,000	2,402,000					1,845,000	23,945,000
2019	19,812,000	477,000	2,474,000			6,739,000		1,900,000	31,402,000
2020	20,407,000	491,000	2,549,000					1,957,000	25,404,000
2021	21,019,000	506,000	0				17,874,000	2,016,000	41,415,000
2022	21,096,000	521,000	0					2,076,000	23,693,000
2023	21,729,000	537,000	0					2,139,000	24,405,000
2024	22,380,000	553,000	979,000					2,203,000	26,115,000
2025	23,052,000	570,000	1,008,000					2,269,000	26,899,000
2026	23,743,000	587,000	1,038,000					2,337,000	27,705,000
2027	23,172,000	604,000	1,069,000					2,407,000	27,252,000
2028	23,867,000	622,000	1,101,000					2,479,000	28,069,000
2029	24,583,000	641,000	1,134,000					2,554,000	28,912,000
2030	25,321,000	660,000	1,168,000					2,630,000	29,779,000
2031	26,080,000	680,000	1,203,000					2,709,000	30,672,000
2032	26,416,000	701,000	2,803,000					2,790,000	32,710,000
2033	27,209,000	722,000	2,887,000					2,874,000	33,692,000
2034	28,025,000	743,000	2,974,000					2,960,000	34,702,000
2035	28,866,000	766,000	3,063,000					3,049,000	35,744,000
2036	29,732,000	789,000	3,155,000					3,141,000	36,817,000
2037	31,745,000	812,000	3,250,000					3,235,000	39,042,000
2038	32,697,000	837,000	3,347,000					3,332,000	40,213,000
2039	33,678,000	862,000	3,447,000					3,432,000	41,419,000
2040	34,689,000	887,000	3,551,000					3,535,000	42,662,000
2041	35,729,000	914,000	3,657,000					3,641,000	43,941,000
2042	37,401,000	942,000	3,767,000					3,750,000	45,860,000
2043	38,523,000	970,000	3,880,000					3,863,000	47,236,000
2044	39,679,000	999,000	1,768,000					3,979,000	46,425,000
2045	40,869,000	1,029,000	1,821,000					4,098,000	47,817,000
2046	42,095,000	1,060,000	1,875,000					4,221,000	49,251,000
2047	41,677,000	1,091,000	1,931,000					4,347,000	49,046,000
2048	42,928,000	1,124,000	1,989,000					4,478,000	50,519,000
2049	44,215,000	1,158,000	2,048,000					4,612,000	52,033,000
2050	45,542,000	1,193,000	2,110,000					4,751,000	53,596,000
2051	46,908,000	1,228,000	2,173,000					4,893,000	55,202,000
Total	$1,141,868,000	$29,250,000	$85,174,000	$721,000	$7,037,000	$6,739,000	$17,874,000	$116,395,000	$1,405,158,000

Pumping and Storage

Information regarding recommended pumping and storage capital improvements is presented in Tables 4-6 through 4-9. Due to the large number of facilities and the need for periodic upgrades, schedules and estimated costs for improvements are presented separately.

Table 4-6 presents a schedule for recommended pumping improvements. Upgrade categories include replacement of motor control centers (MCCs), pumps, HVAC equipment, and flat roofs. Roof recoating rather than replacement was included for sloped metal roofs. Costs are also included for the pumping improvements required to meet future demands that were discussed under Task 4.1. The schedule in Table 4-6 is based on replacement intervals of 20 years for roof work, 25 years for HVAC, and 40 years for pumps and MCCs. These replacement intervals are consistent with historic scheduling of PWSA capital improvement projects.

Table 4-7 presents concept level cost estimates for recommended capital improvements to PWSA pumping facilities. Project cost estimates for the various activities include estimated construction costs plus a 25 percent construction contingency and a 15 percent allowance for project costs. For activities scheduled in future years, 2011 project cost estimates were increased by 3 percent per year. The cost for recommended pumping improvements is estimated to be $35.018 million over the 40-year planning period.

Table 4-8 is a schedule for recommended storage improvements. Upgrades include installation of floating reservoir covers, repairs to floating covers, sandblasting and painting of steel tanks, repair of concrete tanks, replacement of steel tanks, installation of systems to reduce TTHM concentrations in water storage tanks, and reservoir cleaning. Upgrades to certain storage facilities are also scheduled based on future requirements discussed under Task 4.1. These upgrades include the following:

- Replace the existing Garfield 1.90 MG elevated tank with two 1.45 MG tanks.
- Replace the existing Herron Hill 0.40 MG elevated tank with two 0.65 MG elevated tanks.
- Replace the existing Lincoln 3.00 MG standpipe with two 2.60 MG standpipes.
- Replace the existing Squirrel Hill 3.00 MG standpipe with two 1.40 MG elevated tanks.

The schedule in Table 4-8 is based on repairs to floating covers every 10 years, floating cover replacement every 20 years, tank painting every 20 years and concrete tank repairs every 20 years. Tank replacements were scheduled at the end of a painting cycle when the tank age exceeded 70 years. The schedule also includes cleaning and installation of a floating cover on the Highland No. 1 Reservoir.

Table 4-6
Schedule for Recommended Capital Improvements - Pumping

Year	Aspinwall Pump Station	Bruecken Pump Station	Fox Chapel Pump Station	Herron Hill Pump Station	Her. Hill Tank Pump Station	Highland Pump Station	Howard Pump Station	Lincoln Pump Station	Mission Pump Station	Saline Pump Station
2012						Replace MCC				Replace Roof
2013		Recoat Roof				Replace HVAC	Replace HVAC			
2014										
2015				Recoat Roof					Interior Bldg. Rehab.	
2016	Replace Roof						Replace MCC	Replace MCC	Recoat Roof	
2017									Exterior Bldg. Rehab.	
2018									Replace 3 Pumps	
2019										
2020								Replace Pumps		
2021	Recoat Roof	Replace MCC			Replace HVAC	Replace Roof			Replace MCC	
2022					Replace MCC				Replace Roof	
2023						Replace Pumps				
2024							Recoat Roof			
2025										
2026	Replace MCC									
2027		Replace HVAC		Replace HVAC						
2028				Replace Pumps	Replace Pumps					
2029	Replace Pumps	Replace Roof								
2030										Replace MCC
2031				Replace MCC				Replace Roof		Replace HVAC
2032									Replace 2 Pumps	Replace Roof
2033		Recoat Roof							Replace HVAC	
2034								Replace HVAC		
2035				Recoat Roof						
2036	Replace Roof								Recoat Roof	
2037										
2038						Replace HVAC	Replace HVAC			
2039										
2040										
2041	Recoat Roof					Replace Roof				
2042									Replace Roof	
2043			Replace Pumps							
2044			Replace MCC				Recoat Roof			
2045										
2046										
2047										
2048										
2049		Replace Pumps								
2050										Replace Pumps
2051							Replace Pumps	Replace Roof		

Replace MCC = replace motor control center
Replace Pumps = replace pumps and motors
Replace HVAC = replace boiler or unit heaters

Replace Roof = replace flat rubber roof
Recoat Roof = recoat sloped metal roof
Interior Bldg. Rehab - Rehabilitate Pump Station Interior

Exterior Bldg. Rehab. - Rehabilitate Pump Station Exterior

Table 4-7
Concept Level Cost Estimates for Recommended Capital Improvements - Pumping

Year	Aspinwall Pump Station	Bruecken Pump Station	Fox Chapel Pump Station	Herron Hill Pump Station	Her. Hill Tank Pump Station	Highland Pump Station	Howard Pump Station	Lincoln Pump Station	Mission Pump Station	Saline Pump Station	Total
2012						123,000				7,000	$130,000
2013		32,000				105,000	502,000				639,000
2014											0
2015				32,000					791,000		823,000
2016	41,000						224,000	81,000	45,000		391,000
2017									536,000		536,000
2018									899,000		899,000
2019											0
2020								536,000			536,000
2021	49,000	328,000			6,000	14,000			159,000		556,000
2022					121,000				28,000		149,000
2023						309,000					309,000
2024							70,000				70,000
2025											0
2026	382,000										382,000
2027		499,000		442,000							941,000
2028				1,327,000	83,000						1,410,000
2029	3,570,000	15,000									3,585,000
2030										338,000	338,000
2031				337,000				15,000		8,000	360,000
2032									906,000	12,000	918,000
2033		58,000							743,000		801,000
2034								156,000			156,000
2035				57,000							57,000
2036	74,000								81,000		155,000
2037											0
2038						220,000	1,052,000				1,272,000
2039											0
2040											0
2041	88,000					26,000					114,000
2042									50,000		50,000
2043			1,460,000								1,460,000
2044			186,000				126,000				312,000
2045											0
2046											0
2047											0
2048											0
2049		11,476,000									11,476,000
2050										1,667,000	1,667,000
2051							4,499,000	27,000			4,526,000
Total	$4,204,000	$12,408,000	$1,646,000	$2,195,000	$210,000	$797,000	$6,473,000	$815,000	$4,238,000	$2,032,000	$35,018,000

Table 4-8
Schedule for Recommended Capital Improvements - Storage

Year	Herron Hill Reservoir	Highland 1 Reservoir	Highland 2 Reservoir	Lanpher Reservoir	Allentown No 1 Tank	Allentown No 2 Tank	Bedford Tank	Brashear No 1 Tank	Brashear No 2 Tank	Garfield Tank	Herron Hill Tank	Lincoln Tank	McNaugher No 1 Tank	McNaugher No 2 Tank	Spring Hill No 1 Tank	Spring Hill No 2 Tank	Squirrel Hill Tank
2012					Paint	Paint											
2013					TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM	TTHM
2014																	
2015																	
2016							Paint										
2017	Install FC			Install FC													
2018													Repair	Repair			
2019		Clean															
2020		Install FC															
2021			Repair FC							Replace +					Replace	Replace	
2022												Replace ++					
2023																	
2024																	
2025																	
2026																	
2027	Repair FC			Repair FC													
2028																	
2029								Paint	Paint								
2030		Repair FC															
2031			Install FC								Replace x						Replace *
2032					Replace	Replace											
2033																	
2034																	
2035																	
2036							Paint										
2037	Install FC			Install FC													
2038													Repair	Repair			
2039																	
2040		Install FC															
2041			Repair FC							Paint					Paint	Paint	
2042												Paint					
2043																	
2044																	
2045																	
2046																	
2047	Repair FC			Repair FC													
2048																	
2049								Paint	Paint								
2050		Repair FC															
2051			Install FC								Paint						Paint

Install FC = install floating cover
Repair FC = repair floating cover
Paint = sandblast and paint steel tank
Replace = replace steel tank
Repair = repair concrete tank
TTHM = install TTHM reduction system
Clean = clean reservoir

+ Replace Garfield 1.90 MG elevated tank with two 1.45 MG elevated tanks
x Replace Herron Hill 0.40 MG elevated tank with two 0.65 MG elevated tanks
++ Replace Lincoln 3.00 MG standpipe with two 2.60 MG standpipes
* Replace Squirrel Hill 3.00 MG standpipe with two 1.40 MG elevated tanks

Table 4-9
Concept Level Cost Estimates for Recommended Capital Improvements - Storage

Year	Herron Hill Reservoir	Highland 1 Reservoir	Highland 2 Reservoir	Lanpher Reservoir	Allentown No. 1 Tank	Allentown No. 2 Tank	Bedford Tank	Brashear No. 1 Tank	Brashear No. 2 Tank	Garfield Tank	Herron Hill Tank	Lincoln Tank	McNaugher No. 1 Tank	McNaugher No. 2 Tank	Spring Hill No. 1 Tank	Spring Hill No. 2 Tank	Squirrel Hill Tank	Total
2012					$519,000	$519,000												$1,038,000
2013					111,000	111,000	95,000	159,000	159,000	111,000	80,000	111,000	159,000	80,000	80,000	80,000	111,000	1,447,000
2014																		0
2015																		0
2016							560,000											560,000
2017	530,000			3,224,000														3,754,000
2018													550,000	96,000				646,000
2019		1,089,000																1,089,000
2020		5,538,000																5,538,000
2021			800,000							15,654,000					735,000	735,000		17,924,000
2022												5,235,000						5,235,000
2023																		0
2024																		0
2025																		0
2026																		0
2027	810,000			857,000														1,667,000
2028																		0
2029								1,874,000	1,874,000									3,748,000
2030		1,472,000																1,472,000
2031			5,436,000								9,663,000						20,330,000	35,429,000
2032					3,935,000	3,935,000												7,870,000
2033																		0
2034																		0
2035																		0
2036							1,012,000											1,012,000
2037	957,000			5,823,000														6,780,000
2038													993,000	174,000				1,167,000
2039																		0
2040		10,002,000																10,002,000
2041			1,445,000							5,007,000					368,000	368,000		7,188,000
2042												2,297,000						2,297,000
2043																		0
2044																		0
2045																		0
2046																		0
2047	1,464,000			1,548,000														3,012,000
2048																		0
2049								3,385,000	3,385,000									6,770,000
2050		2,658,000																2,658,000
2051			9,819,000								6,033,000						6,497,000	22,349,000
Total	$3,761,000	$20,759,000	$17,500,000	$11,452,000	$4,565,000	$4,565,000	$1,667,000	$5,418,000	$5,418,000	$20,772,000	$15,776,000	$7,643,000	$1,702,000	$350,000	$1,183,000	$1,183,000	$26,938,000	$150,652,000

Table 4-9 presents concept level cost estimates for recommended capital improvements to PWSA storage facilities. Project cost estimates include estimated construction costs plus a 25 percent construction contingency and a 15 percent allowance for project costs. For activities scheduled in future years, 2011 project cost estimates were increased by 3 percent per year. The cost for recommended storage improvements over the 40-year planning period is estimated to be $150.652 million.

Treatment

Table 4-10 presents concept level cost estimates for recommended capital improvements to PWSA treatment facilities. Project cost estimates include estimated construction costs plus a 25 percent construction contingency and a 15 percent allowance for project costs. The 2011 project cost estimates were increased by 3 percent per year for projects scheduled in the future. A $250,000 construction cost allowance is allocated for repairs to the access tunnel at the Aspinwall water treatment plant. Filter rehabilitation and clearwell renovation costs are based on the construction cost estimates discussed under Task 4.3. The cost for recommended treatment improvements over the 40-year planning period is estimated to be $401.607 million.

Sewers

Table 4-11 presents concept level cost estimates for recommended capital improvements to PWSA sewers. Costs for these items are based on the project costs discussed under Task 4.8 and presented in Table 4-4. Project cost estimates for activities scheduled in future years were increased by 3 percent per year. Sewer improvement costs also include $1.00 million per year expenditure for COA compliance, $1.50 million for joint venture projects with URA, PennDot, and other agencies, and a $2 million annual allowance for other sewer system improvements. The cost for recommended capital improvements to the sewer system over the 40-year planning period is estimated to be $604.995 million.

GIS

Table 4-12 presents concept level cost estimates for recommended capital improvements for GIS activities. Improvements include upgrades to GPS equipment, purchase of laptop computers for field crews, software upgrades, and server upgrades. Costs for these items are based on the information presented under Task 3.8. The estimated cost for GIS capital improvements is estimated at $2.101 million over the planning period.

Table 4-10
Concept Level Cost Estimates for Recommended Capital Improvements - Treatment

Year	Description	Total
2012	Access Tunnel Rehabilitation	$361,000
2013	Filter Rehabilitation	17,452,000
2014	Filter Rehabilitation, SCADA Upgrade	24,094,000
2015	Drain, Clean, and Inspect Sedimentation Basins	20,084,000
2016	Chemical Feed Upgrades	6,587,000
2017	Clearwell Renovation	23,302,000
2018	Clearwell Renovation	24,001,000
2019	Clearwell Renovation	24,721,000
2020	Clearwell Renovation	25,462,000
2021	Water Treatment Plant - Replace Motor Control Centers	329,000
2022	SCADA Upgrade	7,752,000
2023		0
2024		0
2025		0
2026	Ross Pump Station - Boiler Replacement	1,688,000
2027		0
2028		0
2029		0
2030	SCADA Upgrade	9,820,000
2031		0
2032		0
2033		0
2034	Clarifier Rehabilitation - New Sludge Collectors and Joint Repairs	10,359,000
2035	Replace Sand Filters With Membrane Filters	25,613,000
2036	Replace Sand Filters With Membrane Filters	26,382,000
2037	Replace Sand Filters With Membrane Filters	27,173,000
2038	Replace Sand Filters With Membrane Filters, SCADA Upgrade	40,427,000
2039		0
2040	Chemical Feed Upgrades	13,390,000
2041	Drain, Clean, and Inspect Sedimentation Basins	21,656,000
2042	Drain, Clean, and Inspect Sedimentation Basins	22,306,000
2043		0
2044		0
2045		0
2046	SCADA Upgrade	15,758,000
2047		0
2048		0
2049	Ross Pump Station - Replace Motor Control Centers	753,000
2050	Ross Pump Station - Replace Pumps and Motors	8,602,000
2051	Ross Pump Station - Boiler Replacement	3,535,000
Total		$401,607,000

Table 4-11
Concept Level Cost Estimates for Recommended Capital Improvements - Sewers *

Year	Sewage Pump Station Upgrades	Becks Run CSO Improvements	Bells Run CSO Improvements	East Street CSO Improvements	Little Saw Mill Run CSO Improvements	Lower Nine Mile Run Improvements	McCartney Run CSO Improvements	McDonough's Run CSO Improvements	Negley Run CSO Improvements	Plummers Run CSO Improvements	Streets Run CSO Improvements	Weymans Run CSO Improvements	Brook, Englert Brookline CSO Improvements	COA Compliance	Joint Venture Projects	General Sewer System Improvements	Total
2012	$3,090,000													1,030,000	1,545,000	2,060,000	$7,725,000
2013														1,061,000	1,591,000	2,122,000	4,774,000
2014		1,595,000		6,338,000			6,666,000					2,262,000		1,093,000	1,639,000	2,185,000	21,778,000
2015			7,995,000		10,077,000									1,126,000	1,688,000	2,251,000	23,137,000
2016			8,235,000		10,379,000									1,159,000	1,739,000	2,319,000	23,831,000
2017			8,482,000		10,691,000									1,194,000	1,791,000	2,388,000	24,546,000
2018						10,446,000		7,010,000						1,230,000	1,845,000	2,460,000	22,991,000
2019						10,759,000		7,221,000						1,267,000	1,900,000	2,534,000	23,681,000
2020						11,082,000		7,437,000						1,305,000	1,957,000	2,610,000	24,391,000
2021									17,964,000	13,058,000				1,344,000	2,016,000	2,688,000	37,070,000
2022									18,503,000	13,450,000				1,384,000	2,076,000	2,768,000	38,181,000
2023									19,058,000	13,854,000				1,426,000	2,139,000	2,852,000	39,329,000
2024											4,846,000		4,812,000	1,469,000	2,203,000	2,937,000	16,267,000
2025											4,992,000		4,956,000	1,513,000	2,269,000	3,025,000	16,755,000
2026											5,141,000		5,105,000	1,558,000	2,337,000	3,116,000	17,257,000
2027														1,605,000	2,407,000	3,209,000	7,221,000
2028														1,653,000	2,479,000	3,306,000	7,438,000
2029														1,702,000	2,554,000	3,405,000	7,661,000
2030														1,754,000	2,630,000	3,507,000	7,891,000
2031														1,806,000	2,709,000	3,612,000	8,127,000
2032														1,860,000	2,790,000	3,721,000	8,371,000
2033														1,916,000	2,874,000	3,832,000	8,622,000
2034														1,974,000	2,960,000	3,947,000	8,881,000
2035														2,033,000	3,049,000	4,066,000	9,148,000
2036														2,094,000	3,141,000	4,188,000	9,423,000
2037														2,157,000	3,235,000	4,313,000	9,705,000
2038														2,221,000	3,332,000	4,443,000	9,996,000
2039														2,288,000	3,432,000	4,576,000	10,296,000
2040														2,357,000	3,535,000	4,713,000	10,605,000
2041														2,427,000	3,641,000	4,855,000	10,923,000
2042														2,500,000	3,750,000	5,000,000	11,250,000
2043														2,575,000	3,863,000	5,150,000	11,588,000
2044														2,652,000	3,979,000	5,305,000	11,936,000
2045														2,732,000	4,098,000	5,464,000	12,294,000
2046														2,814,000	4,221,000	5,628,000	12,663,000
2047														2,898,000	4,347,000	5,797,000	13,042,000
2048														2,985,000	4,478,000	5,970,000	13,433,000
2049														3,075,000	4,612,000	6,150,000	13,837,000
2050														3,167,000	4,751,000	6,334,000	14,252,000
2051														3,262,000	4,893,000	6,524,000	14,679,000
Total	$3,090,000	$1,595,000	$24,712,000	$6,338,000	$31,147,000	$32,287,000	$6,666,000	$21,668,000	$55,525,000	$40,362,000	$14,979,000	$2,262,000	$14,873,000	$77,666,000	$116,495,000	$155,330,000	$604,995,000

* Estimated PWSA Share of Sewer Improvement Costs Based on Zero Overflows in a Typical Year and a 2-year Design Storm Level of Control. Costs Are Allocated Between PWSA and Municipalities Based Upon Peak Flow Contributions

Table 4-12
Concept Level Cost Estimates for Recommended Capital Improvements - GIS

Year	RTK GPS	Laptops For Field Crews	ArcGIS Software Upgrades	GIS Server Upgrades	Total
2012	$31,000	$26,000	$5,000	$5,000	$67,000
2013					0
2014		14,000			14,000
2015		14,000		6,000	20,000
2016		20,000	6,000		26,000
2017	36,000	24,000			60,000
2018		22,000		6,000	28,000
2019		25,000			25,000
2020		23,000	7,000		30,000
2021		27,000		7,000	34,000
2022	42,000	24,000			66,000
2023		29,000			29,000
2024		26,000	7,000	7,000	40,000
2025		30,000			30,000
2026		27,000			27,000
2027	48,000	32,000		8,000	88,000
2028		29,000	8,000		37,000
2029		34,000			34,000
2030		31,000		9,000	40,000
2031		36,000			36,000
2032	56,000	33,000	9,000		98,000
2033		38,000		10,000	48,000
2034		35,000			35,000
2035		41,000			41,000
2036		37,000	10,000	10,000	57,000
2037	65,000	43,000			108,000
2038		39,000			39,000
2039		46,000		11,000	57,000
2040		41,000	12,000		53,000
2041		49,000			49,000
2042	75,000	44,000		13,000	132,000
2043		52,000			52,000
2044		46,000	13,000		59,000
2045		55,000		14,000	69,000
2046		49,000			49,000
2047	87,000	58,000			145,000
2048		52,000	15,000	15,000	82,000
2049		61,000			61,000
2050		55,000			55,000
2051		65,000		16,000	81,000
Total	$440,000	$1,432,000	$92,000	$137,000	$2,101,000

Total Costs

Table 4-13 summarizes total costs for recommended capital improvements to the PWSA system. The total cost for improvements over the 40-year planning period is estimated to be $2.60 billion. Distribution system improvements account for about 54 percent of the total.

Expenditures for recommended capital improvements during the eight, five-year plans are summarized below:

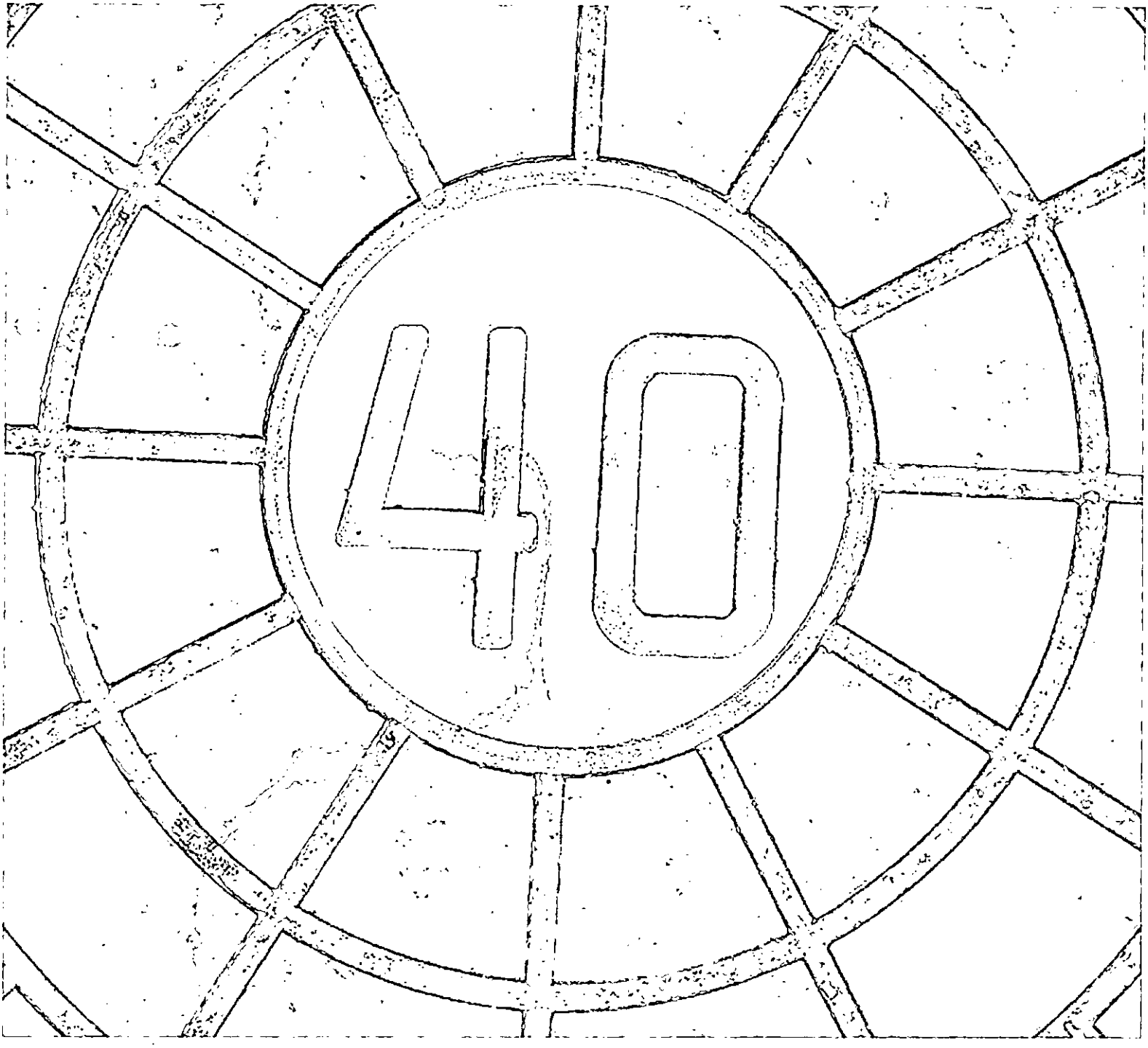
Capital Plan	Total Expenditure
First Five-Year Plan	$263,294,000
Second Five-Year Plan	407,563,000
Third Five-Year Plan	272,383,000
Fourth Five-Year Plan	242,027,000
Fifth Five-Year Plan	291,712,000
Sixth Five-Year Plan	388,277,000
Seventh Five-Year Plan	338,864,000
Eighth Five-Year Plan	395,411,000
Total	$2,559,531,000

Recommended capital expenditures for the five-year planning periods range from a high of $408 million to a low of $242 million and average $325 million per 5-year planning period or $65 million per year.

Table 4-13
Summary of Recommended Capital Improvement Costs

Year	Distribution	Pumping and Storage	Treatment	Sewers	GIS	Annual Total	Five-Year Capital Plan Total
2012	$19,689,000	$1,168,000	$361,000	$7,725,000	$67,000	$29,010,000	
2013	19,537,000	2,086,000	17,452,000	4,774,000	0	43,849,000	
2014	27,160,000	0	24,094,000	21,778,000	14,000	73,046,000	
2015	20,727,000	823,000	20,084,000	23,137,000	20,000	64,791,000	
2016	21,203,000	951,000	6,587,000	23,831,000	26,000	52,598,000	263,294,000
2017	23,248,000	4,290,000	23,302,000	24,546,000	60,000	75,446,000	
2018	23,945,000	1,545,000	24,001,000	22,991,000	28,000	72,510,000	
2019	31,402,000	1,089,000	24,721,000	23,681,000	25,000	80,918,000	
2020	25,404,000	6,074,000	25,462,000	24,391,000	30,000	81,361,000	
2021	41,415,000	18,480,000	329,000	37,070,000	34,000	97,328,000	407,563,000
2022	23,693,000	5,384,000	7,752,000	38,181,000	66,000	75,076,000	
2023	24,405,000	309,000	0	39,329,000	29,000	64,072,000	
2024	26,115,000	70,000	0	16,267,000	40,000	42,492,000	
2025	26,899,000	0	0	16,755,000	30,000	43,684,000	
2026	27,705,000	382,000	1,688,000	17,257,000	27,000	47,059,000	272,383,000
2027	27,252,000	2,608,000	0	7,221,000	88,000	37,169,000	
2028	28,069,000	1,410,000	0	7,438,000	37,000	36,954,000	
2029	28,912,000	7,333,000	0	7,661,000	34,000	43,940,000	
2030	29,779,000	1,810,000	9,820,000	7,891,000	40,000	49,340,000	
2031	30,672,000	35,789,000	0	8,127,000	36,000	74,624,000	242,027,000
2032	32,710,000	8,788,000	0	8,371,000	98,000	49,967,000	
2033	33,692,000	801,000	0	8,622,000	48,000	43,163,000	
2034	34,702,000	156,000	10,359,000	8,881,000	35,000	54,133,000	
2035	35,744,000	57,000	25,613,000	9,148,000	41,000	70,603,000	
2036	36,817,000	1,167,000	26,382,000	9,423,000	57,000	73,846,000	291,712,000
2037	39,042,000	6,780,000	27,173,000	9,705,000	108,000	82,808,000	
2038	40,213,000	2,439,000	40,427,000	9,996,000	39,000	93,114,000	
2039	41,419,000	0	0	10,296,000	57,000	51,772,000	
2040	42,662,000	10,002,000	13,390,000	10,605,000	53,000	76,712,000	
2041	43,941,000	7,302,000	21,656,000	10,923,000	49,000	83,871,000	388,277,000
2042	45,860,000	2,347,000	22,306,000	11,250,000	132,000	81,895,000	
2043	47,236,000	1,460,000	0	11,588,000	52,000	60,336,000	
2044	46,425,000	312,000	0	11,936,000	59,000	58,732,000	
2045	47,817,000	0	0	12,294,000	69,000	60,180,000	
2046	49,251,000	0	15,758,000	12,663,000	49,000	77,721,000	338,864,000
2047	49,046,000	3,012,000	0	13,042,000	145,000	65,245,000	
2048	50,519,000	0	0	13,433,000	82,000	64,034,000	
2049	52,033,000	18,246,000	753,000	13,837,000	61,000	84,930,000	
2050	53,596,000	4,325,000	8,602,000	14,252,000	55,000	80,830,000	
2051	55,202,000	26,875,000	3,535,000	14,679,000	81,000	100,372,000	395,411,000
Total	$1,405,158,000	$185,670,000	$401,607,000	$604,995,000	$2,101,000	$2,599,531,000	$2,599,531,000

APPENDIX 1-1



The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Project Kickoff Meeting
Tuesday, October 5, 2010, PWSA Training Room
Meeting Minutes

Attendees: PWSA – Tom Gigliotti, Bob Hutton, Michael Kenney, Jeff Lenner, Rick Obermeier, Tom Palmosina, Steve Simcic, Stanley States, Don Waldorf.
Chester Engineers – Chuck Brence, Ralph Eyerman, Charlie Jordan, John Maslanik, Michael McKee, Bill Sukenik
Collective Efforts – Kathy Chavara

Meeting Handouts / Attachments

1. Agenda
2. Project Organization Chart
3. Project Schedule

Items Discussed

1. Introductions
   a) All attendees introduced themselves to the group.

2. Project Organization
   a) See attached Organization Chart
   b) Jeff Lenner is the PWSA Project Manager.
   c) Charlie Jordan is the Chester Project Manager.
   d) Bill Sukenik is the Chester Principal in Charge.
   e) Mike McKee is the Lead Studies Engineer.
   f) John Maslanik will lead the effort in facilities Planning and Computer Modeling.
   g) Ralph Eyerman will provide expertise in the area of Water and Sewer Distribution.
   h) Chuck Brence and Mark Mellott will focus on improvements to the Water Treatment plant and Storage and Pumping Facilities.
   i) Kathy Chavara of Collective Efforts will provide expertise in the area of Stormwater management and Inter-governmental Coordination.
   j) David Sheridan of Aqua Cura will focus on Green technologies.

3. Communications
   a) Jeff Lenner should be the recipient or be copied on all project correspondence. Charlie Jordan should be the recipient or be copied on all project correspondence.

4. Project Tasks

a) Mike McKee reviewed the scope of work for each of the following project tasks:
   - Task 1 – Project Coordination / Review Meetings
   - Task 2 – Identify Opportunities for Regionalization
   - Task 3 – Complete an Assessment of Needs
   - Task 4 – Develop Recommended Capital Improvements and Actions
   - Task 5 – Prepare a Summary Report.

5. Project Schedule
   a) The project schedule was revised from the RFP. The start date is October 6, 2010. The contract length is 270 days. The completion date is July 3, 2010.
   b) A copy of the revised schedule will be included in the Kickoff Meeting Minutes.

6. Development of Project Objectives
   a) Throughout the meeting, project objectives were discussed. The following lists these objectives and the initials of the speaker:
      - The 40-year Capital Plan should focus on asset management. (M.K.)
      - PWSA's 2005 value assessment is coming along; it focuses on the primary mains. Discussions included the desire for "sort-able" presentation so that items like Leak Detection, Reoccurring Breaks, etc can be easily searched and defined. The PWSA SAP includes some of this information from work completed over the last 3 years. Whatever is determined to be the best means to gather, compile and ultimately search data should be used and compatible with current PWSA reports, work notifications. This will roll into more of a Management Asset Planning document. Key items tossed out included street address, pressure districts, replacement lines/valves, zone, GIS data fields, City Wards, etc. (D.W. , B.H.)
      - The sewer system improvements required under the COA will be a big part of the 40-Year Plan. (M.K.)
      - The 40-Year Capital Plan should identify what needs to be done in the next 40 years, as well as determine the impact that the recommended improvements will have on user rates (what needs to be done versus what you can afford to do with respect to rates). (M.K.)
      - Requirements related to the Consent Decree/Feasibility Study being conducted will need documented proof of the cost implications. This costing should be prepared so the cost implications can be presented to the PWSA Board. Costing is needed for Board, Bonding Agencies, Public, etc. to fully understand maintenance/improvement costs. Costing information will need to be fed into the Cogsdale environment, which is the PWSA platform that will be financed in 3rd quarter of 2011 and operational about the 1st quarter of 2012.(M.K.).
      - Cogsdale (PWSA's future Financial Management software package) has a long-term planning component. (S.S.)
      - The ultimate goal is to link PWSA's GIS to SAP/Cogsdale. (S.S.)

- Cogsdale has an 18-month implementation schedule and is expected to be operational in the 1st quarter of 2012. (S.S.)
- The stormwater management approach for Pittsburgh needs to be coordinated between PWSA, the City and its agencies / authorities, PENNDOT, and County Agencies. Jeff Lenner to be kept abreast of all meetings. (M.K.)
- Meetings should be scheduled with City Planning, the Sports and Exhibition Authority (SEA), the Urban Redevelopment Authority (URA) and County Planning to get their input. Directors will need to provide Chester with their valuable input. (M.K.)
- The 40-Year Plan is the template for the future and input from PWSA staff will be invaluable. (M.K.)
- The 40-Year Plan has to factor in green energy. Harnessing hydroelectric power at the Highland Dam, Emsworth Dam, and Braddock Dam could be a huge savings for PWSA. (D.W.)
- The Emsworth Dam is already set up for hydroelectric power generation. (D.W.)
- By 2013, PWSA is committed to break out water and sewer costs for PENNVEST. (S.S.)
- Need to look at rates and determine the breakdown of water and sewer costs. Can't supplement sewer with revenue from water rates and vice-versa. (M.K.)
- Of the 5 major problems facing PWSA, CSOs are #1. Suggestion was to look at what Washington Suburban is doing as they have had multiple year rate increases planned and media highlights needs of the system. (T.G.)
- Monthly progress meetings for the project should be scheduled now. Each meeting should last a maximum of 1 hour. The progress meetings should focus on action items, not completed tasks. (M.K.)
- Progress meetings as tentatively scheduled for the last Monday of the month. (C.J.)
- The PWSA system has been neglected for years. PWSA needs to institute multiple year rate increases to finance system improvements, similar to what the Washington Suburban Sanitary Commission has done. (M.K.)
- Target levels of service for the 40-Year Plan are as follows: (M.K.)
  - 40 psi minimum water pressure
  - 500 gpm minimum fire flow
  - No sewer backups (at the end of 40 years)
- New storm sewers are designed for a 25-year storm. Existing storm sewers may be designed for 1, 2, 5, or 10-year storms. (D.W.)
- New development is required to install separate storm and sanitary sewers; therefore, storm sewer separation will occur over time. (D.W.)
- The 40-Year Plan should list the criteria needed to meet future requirements for stormwater CSOs. (M.K.)
- Capital improvements should build in redundancy for critical areas, such as the Herron Hill Reservoir which feeds hospitals but turns over once a day. (M.K.)

- Also address redundancy problems with Highland Reservoirs – pump from Highland #2 to Highland #1 or cover reservoir. (M.K.)
- Develop internal questionnaire for PWSA department heads to get input on the items that need to be addressed in the 40-Year Capital Plan. (M.K.)

7. Development of Key Topics for Progress Meetings
   - Monthly progress meetings for the project should be scheduled now. Each meeting should last a maximum of 1 hour. The progress meetings should focus on action items, not completed tasks. (M.K.)
   - Progress meetings are tentatively scheduled for the last Monday of the month. (C.J.)

8. Action Items
   a) Chester to develop internal questionnaire for PWSA department heads to get input on the items that need to be addressed in the 40-Year Capital Plan.
   b) Jeff Lenner and Charlie Jordan to arrange schedule for monthly progress meetings.

9. Next Meeting
   a) Tuesday, October 26, 2010 at 9:30 AM.

Please submit any corrections or additional comments to these meeting minutes to me at cjordan@chesterengineers.com. Comments must be submitted by October 22, 2010.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

The Pittsburgh Water and Sewer Authority

40-Year Capital Plan

PWSA Project R-D1.10015

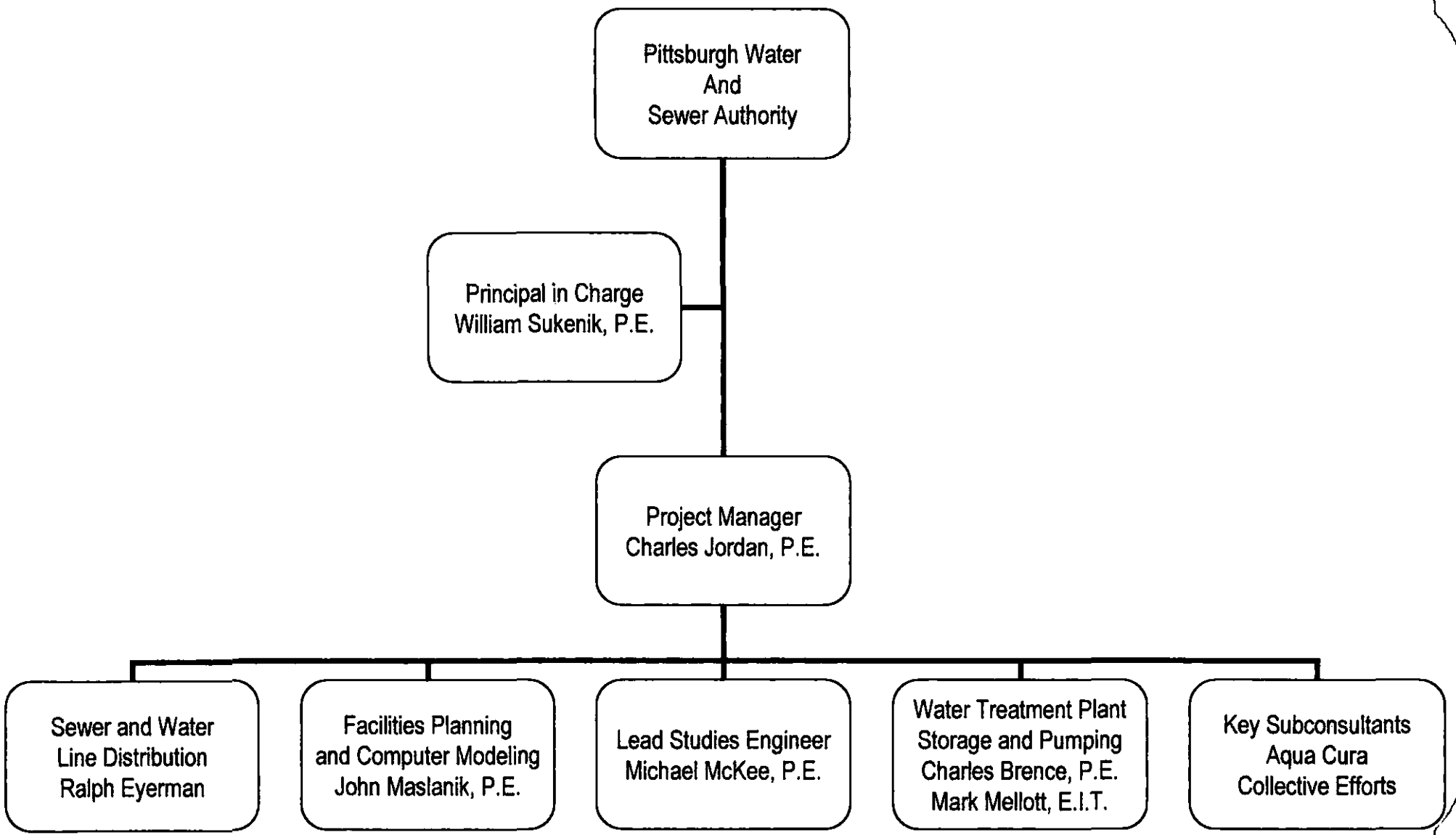
Project Kickoff Meeting

Tuesday, October 5, 2010

Meeting Agenda

- Introductions
- Project Organization
  - Define Roles of PWSA Staff and Chester Team Members
- Communications
- Project Tasks
- Project Schedule
- Development of Project Objectives
- Development of Key Topics for Progress Meetings

Organization Chart



Project Tasks

- Task 1: Project Coordination/Review Meetings
- Task 2: Identify Opportunities for Regionalization
- Task 3: Complete an Assessment of Needs
- Task 4: Develop Recommended Capital Improvements and Actions
- Task 5: Prepare a Summary Report

Project Schedule

- Discuss Schedule

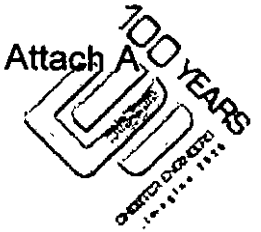
Communications

- Open Discussion

Development of Project Objectives

- Open Discussion

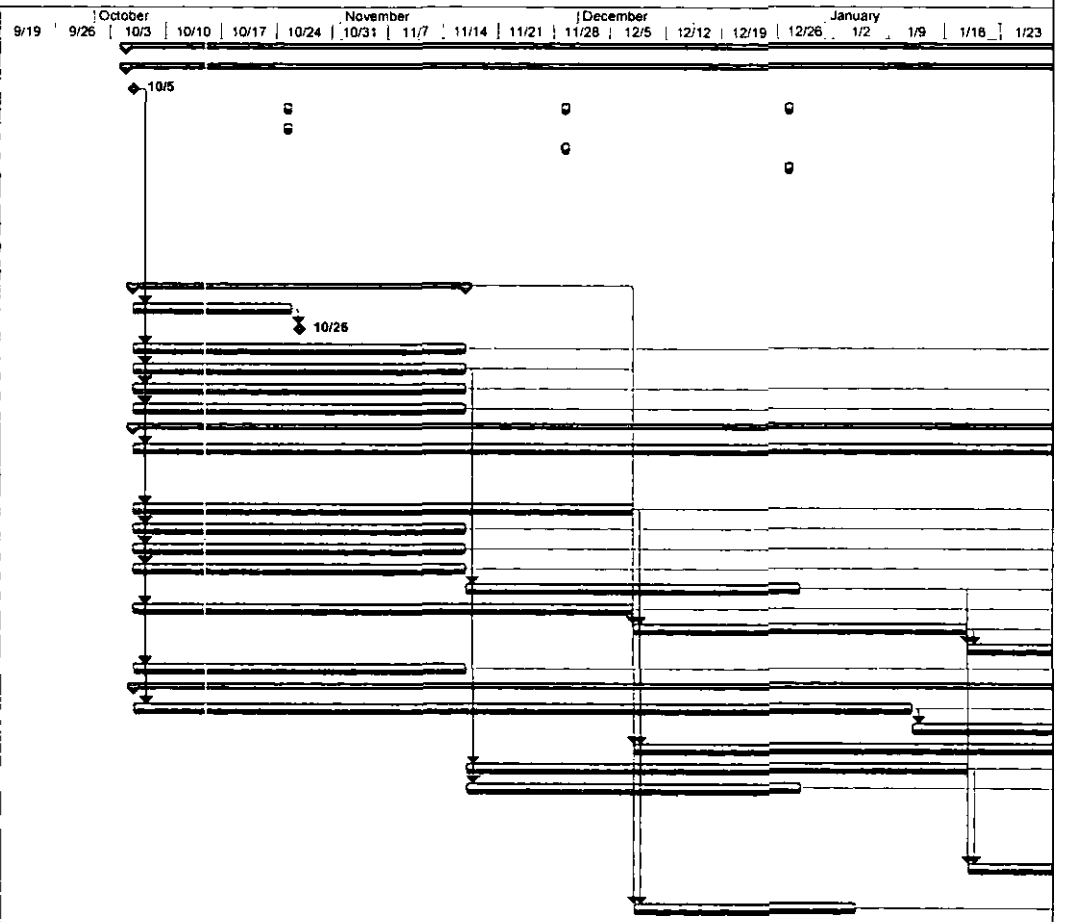
Development of Key Topics for Progress Meetings



- Open Discussion

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN PROJECT
PWSA PROJECT R-D1.10015
PROJECT SCHEDULE

ID	WBS	Task Name	Duration	Start	Finish
1	1	**PWSA - 40 YEAR CAPITAL PLAN**	**193 days**	**Tue 10/5/10**	**Thu 6/30/11**
2	1.1	**Project Coordination**	**170 days**	**Tue 10/5/10**	**Mon 5/30/11**
3	1.1.1	Kickoff Meeting	1 day	Tue 10/5/10	Tue 10/5/10
4	1.1.2	**Progress Meetings**	**156 days**	**Mon 10/25/10**	**Mon 5/30/11**
5	1.1.2.1	Progress Meeting 1	1 day	Mon 10/25/10	Mon 10/25/10
6	1.1.2.2	Progress Meeting 2	1 day	Mon 11/29/10	Mon 11/29/10
7	1.1.2.3	Progress Meeting 3	1 day	Mon 12/27/10	Mon 12/27/10
8	1.1.2.4	Progress Meeting 4	1 day	Mon 1/31/11	Mon 1/31/11
9	1.1.2.5	Progress Meeting 5	1 day	Mon 2/28/11	Mon 2/28/11
10	1.1.2.6	Progress Meeting 6	1 day	Mon 3/28/11	Mon 3/28/11
11	1.1.2.7	Progress Meeting 7	1 day	Mon 4/25/11	Mon 4/25/11
12	1.1.2.8	Progress Meeting 8	1 day	Mon 5/30/11	Mon 5/30/11
13	1.2	**Identify Opportunities for Regionalization**	**30 days**	**Wed 10/6/10**	**Tue 11/16/10**
14	1.2.1	Coordinate Growth Initiative Meeting	14 days	Wed 10/6/10	Mon 10/25/10
15	1.2.2	Conduct Growth Initiative Meeting	1 day	Tue 10/26/10	Tue 10/26/10
16	1.2.3	Review Water and System Regionalization in Other Locals	30 days	Wed 10/6/10	Tue 11/16/10
17	1.2.4	Investigate Potential Areas of Water System Expansion	30 days	Wed 10/6/10	Tue 11/16/10
18	1.2.5	Investigate Water System Expansion Into City PAWC Service Area	30 days	Wed 10/6/10	Tue 11/16/10
19	1.2.6	Investigate Potential Areas of Sewer System Expansion	30 days	Wed 10/6/10	Tue 11/16/10
20	1.3	**Complete an Assessment of Needs**	**120 days**	**Wed 10/6/10**	**Tue 3/22/11**
21	1.3.1	Conduct System Inventory	90 days	Wed 10/6/10	Tue 2/8/11
22	1.3.2	Develop Valuations for Water and Sewer System	30 days	Wed 2/9/11	Tue 3/22/11
23	1.3.3	Identify Water System Improvements Based on Fire Demand	30 days	Wed 2/9/11	Tue 3/22/11
24	1.3.4	Inventory Major Pumping and Treatment Equipment	45 days	Wed 10/6/10	Tue 12/7/10
25	1.3.5	Review Backup Power Needs	30 days	Wed 10/6/10	Tue 11/16/10
26	1.3.6	Determine Strategy for Reduction of Non-Revenue Water	30 days	Wed 10/6/10	Tue 11/16/10
27	1.3.7	Conduct Needs Assessment Based on Safe Drinking Water Regulations	30 days	Wed 10/6/10	Tue 11/16/10
28	1.3.8	Determine Future Pumping and Distribution Needs	30 days	Wed 11/17/10	Tue 12/28/10
29	1.3.9	Review and Expand on Draft CSO Study	45 days	Wed 10/6/10	Tue 12/7/10
30	1.3.10	Determine Future Sewer Needs	30 days	Wed 12/8/10	Tue 1/18/11
31	1.3.11	Evaluate Green Technology	45 days	Wed 1/19/11	Tue 3/22/11
32	1.3.12	Review and Evaluate GIS System	30 days	Wed 10/6/10	Tue 11/16/10
33	1.4	**Develop Recommended Capital Improvements and Actions**	**180 days**	**Wed 10/6/10**	**Tue 6/14/11**
34	1.4.1	Develop Risk Based Analysis Model for Waterline Replacement	70 days	Wed 10/6/10	Tue 1/11/11
35	1.4.2	Prioritize Water Main Replacement	30 days	Wed 1/12/11	Tue 2/22/11
36	1.4.3	Identify Improvements and Upgrades to WTP, Incl Clearwell	40 days	Wed 12/8/10	Tue 2/1/11
37	1.4.4	Identify Areas Requiring Backup Power	45 days	Wed 11/17/10	Tue 1/18/11
38	1.4.5	Develop Plan for Non-Revenue Water & Leak Detection	30 days	Wed 11/17/10	Tue 12/28/10
39	1.4.6	Recommend Solutions to Sewer System	60 days	Wed 3/23/11	Tue 6/14/11
40	1.4.7	Recommend and estimate Cost of Green Technologies	20 days	Wed 3/23/11	Tue 4/19/11
41	1.4.8	Develop Eight Five Year Capital Plans for Water Distribution	20 days	Wed 2/23/11	Tue 3/22/11
42	1.4.9	Develop Eight Five Year Capital Plans for Pumping and Storage	20 days	Wed 1/19/11	Tue 2/15/11
43	1.4.10	Develop Eight Five Year Capital Plans for WTP	20 days	Wed 2/2/11	Tue 3/1/11
44	1.4.11	Develop Eight Five Year Capital Plans for Sewers	20 days	Wed 12/8/10	Tue 1/4/11
45	1.5	**Prepare a Summary Report**	**67 days**	**Wed 3/30/11**	**Thu 6/30/11**
46	1.5.1	Prepare Draft Report	30 days	Wed 3/30/11	Tue 5/10/11
47	1.5.2	Submit Draft Report	1 day	Wed 5/11/11	Wed 5/11/11
48	1.5.3	PWSA Review and Comment	21 days	Thu 5/12/11	Thu 6/9/11
49	1.5.4	Prepare Final Report	14 days	Fri 6/10/11	Wed 6/29/11
50	1.5.5	Submit 25 Copies of Summary report	1 day	Thu 6/30/11	Thu 6/30/11



Project: PWSA 40-YEAR Capital Plan
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN PROJECT
PWSA PROJECT R-D1.10015
PROJECT SCHEDULE

ID	WBS	Task Name
1	1	**PWSA - 40 YEAR CAPITAL PLAN**
2	1.1	**Project Coordination**
3	1.1.1	Kickoff Meeting
4	1.1.2	**Progress Meetings**
5	1.1.2.1	Progress Meeting 1
6	1.1.2.2	Progress Meeting 2
7	1.1.2.3	Progress Meeting 3
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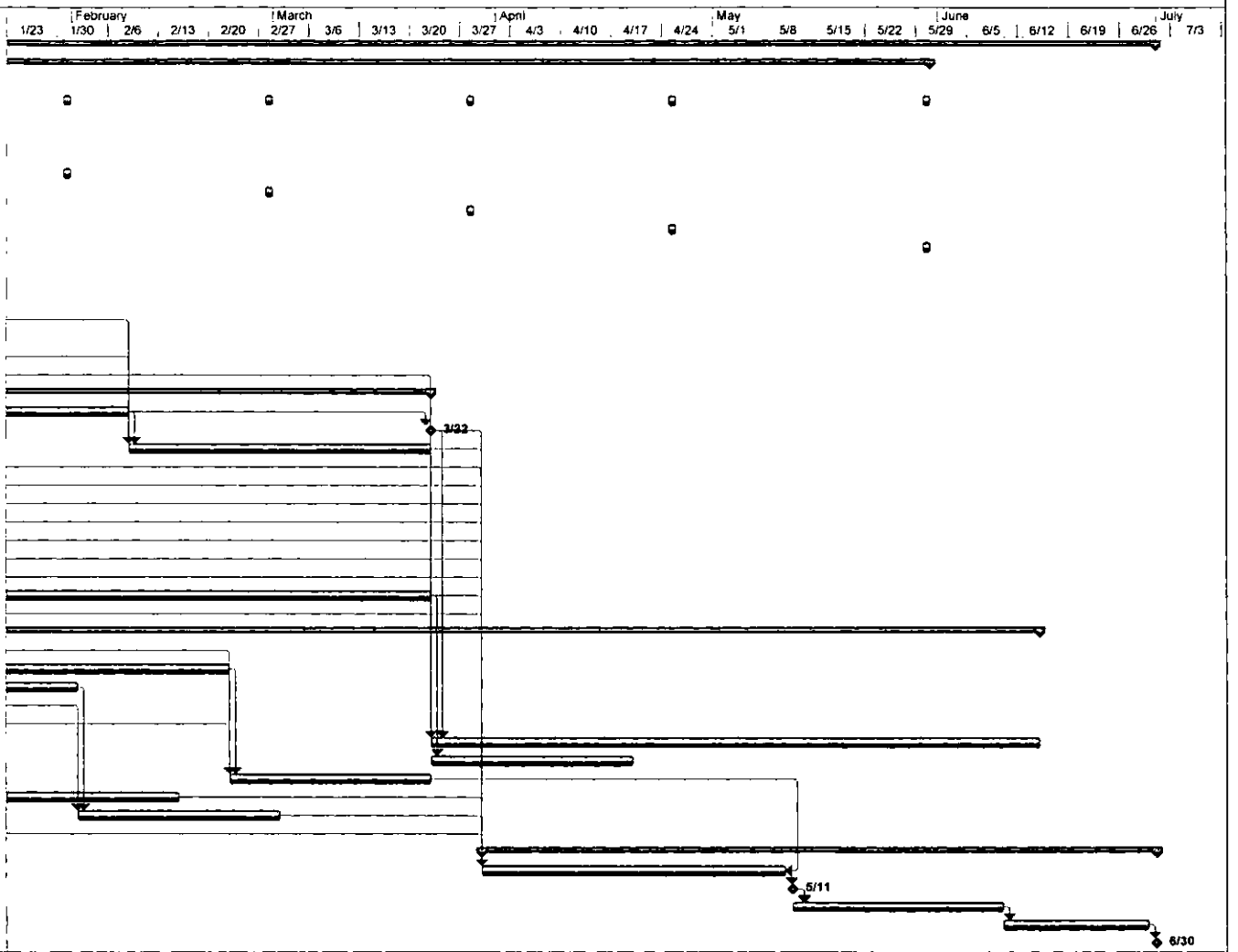
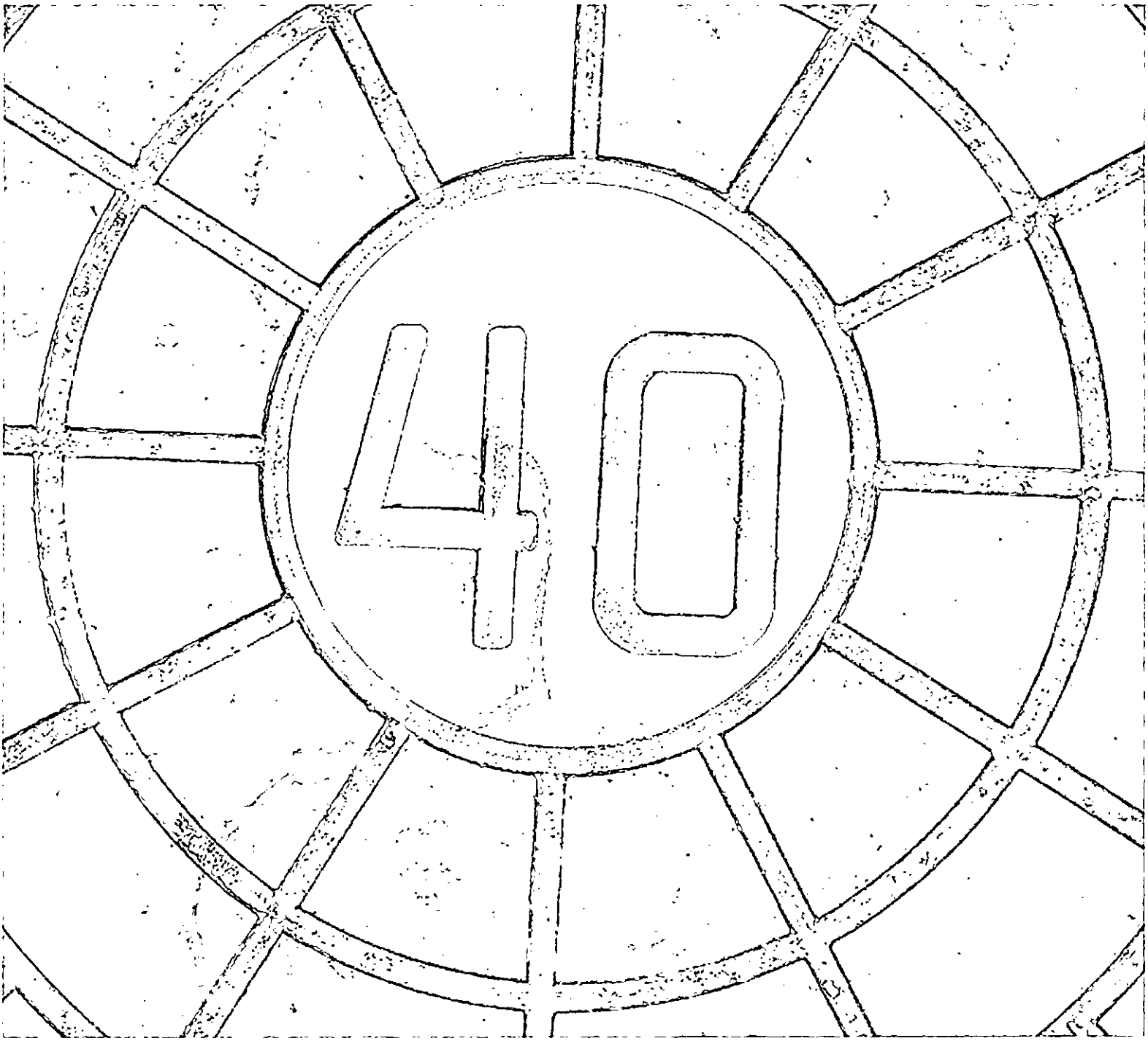
46	1.5.1	Prepare Draft Report
47	1.5.2	Submit Draft Report
48	1.5.3	PWSA Review and Comment
49	1.5.4	Prepare Final Report
50	1.5.5	Submit 25 Copies of Summary report



Project: PWSA 40-YEAR Capital Plan | Task | Progress | Summary | External Tasks | Deadline | Split | Milestone | Project Summary | External Milestone

APPENDIX 1-2



THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 1
FRIDAY OCTOBER 29, 2010 @ 10:00 AM

AGENDA

1. Progress Report

   a. Work has been initiated on all tasks having a 10/6/10 start date per the project schedule. Analysis of sewer surcharging areas has begun (Task 3.5) but work related to specific CSO recommendations is being held off until PWSA review of the Draft CSO Feasibility Study is complete.

   b. Scheduled deliverables before the November 2010 progress meeting include a discussion paper on system regionalization in other areas and interim reports on potential water and sewer system expansion, additional areas of concern, and the GIS system.

2. Action Items

   a. Meeting on internal PWSA questionnaire is scheduled for 11:00 AM today.

   b. Schedule meeting to discuss additional areas of concern (Task 3.3) if not adequately addressed at the internal questionnaire meeting.

   c. Schedule site visits to PWSA water and sewer facilities to complete system inventory (Task 3.1) and inventory of all major pumping and treatment equipment items (Task 3.7).

   d. Schedule meeting to discuss how GIS system can be enhanced to improve O&M activities (Task 3.8).

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 2
TUESDAY NOVEMBER 30, 2010 @ 9:30 AM

AGENDA

1. Progress Report

   a. Arranging meetings with local planning agencies (Task 2.1).

   b. Information regarding Allegheny County water and sewer service providers has been compiled (Tasks 2.3 and 2.4) for screening and further discussion about potential system expansion / acquisitions / water sales.

   c. System Inventory (Task 3.1) and Pumping and Treatment Inventory (Task 3.7) spreadsheets have been compiled based on available information. Mark Mellott has been updating the information prior to the site visits, which will be carried out in December.

   d. The water distribution system model (Task 4.2) has been converted to the InfoWater platform format to facilitate the analysis of distribution system improvements in conjunction with the application of the CapPlan risk based model.

   e. The license for the CapPlan risk based model (Task 4.6) has been obtained. Twenty years of water main break data has been obtained from the PWSA MIS and the cal books. This data has been geolocated in preparation for assignment to specific main segments and the generation of likelihood of failure statistics. Working with the PWSA GIS group to estimate pipe segment ages.

   f. Sewer surcharging (Task 4.9) complaint data has been obtained from the PWSA MIS and has been tabulated and geolocated. This information will be reviewed with PWSA staff to identify chronic – capacity related surcharging problem areas for investigation and development of solutions.

2. Action Items

   a. Need internal questionnaires that have not yet been returned.

   b. Need a copy of the "Water Audit Study" as a starting point for development of a comprehensive leak detection and repair program.

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 3
TUESDAY JANUARY 4, 2011 @ 9:00 AM

AGENDA

1. Progress Report

   a. Meetings with local agencies (City and County Planning Departments, Allegheny County Health Department, PA Department of Environmental Protection) are scheduled to be held in January 2011 (Task 2.1).

   b. System Inventory (Task 3.1) and Pumping and Treatment Inventory (Task 3.7) spreadsheets are being finalized this week based on site visits in December 2010 to the treatment plant, water pumping stations, water storage facilities, and sewage pumping stations. Draft spreadsheets are attached for review.

   c. Methods to reduce total trihalomethanes (TTHMs) in the PWSA system (Task 3.3) have been investigated. Stripping TTHMs from water in storage facilities appears to be the most promising alternative for reducing TTHMs produced as disinfection by-products. The literature review indicates that aeration can remove 70 to 90 percent of TTHMs while having little to no effect on chlorine residuals. Several articles on this subject are attached.

   d. Work continued on the analysis of water main break data (Task 4.2). Individual water main breaks data points are being assigned to the associated water main segment for the purpose of generating main break frequency statistics to be used to generate the water main replacement program.

   e. Population projections from the Southwestern Pennsylvania Commission have been obtained and processed to determine the population change that is projected to occur within each of the service districts. Draft figures illustrating projected population changes are attached. This information is being used to increase water demands in the water model to reflect future demand conditions (Task 3.4).

2. Action Items

   a. Need PWSA internal questionnaires that have not yet been returned.

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 4
TUESDAY JANUARY 25, 2011 @ 9:30 AM

AGENDA

1. Progress Report

   a. A list of local agencies and contacts for meetings regarding potential expansion of the PWSA service area (Task 2.1) is attached.

   b. A draft discussion paper on water and sewer system regionalization (Task 2.2) is attached. The paper discusses primary drivers for regionalization, Pennsylvania statutes on utility consolidation, benefits, and potential problems with regionalization. It also presents barriers to regionalization, discusses the use of eminent domain to purchase water utilities, and discusses methods to advance regionalization efforts.

   c. System Inventory (Task 3.1) and Pumping and Treatment Inventory (Task 3.7) spreadsheets were finalized based on site visits in December 2010 to the treatment plant, water pumping stations, water storage facilities, and sewage pumping stations. Final spreadsheets are attached.

   d. The draft water audit study was reviewed as the first step in developing a leak detection and repair program (Task 4.7). Results of the draft water audit are summarized in the attached file. A graph that compares service population to the amount of water delivered to the system between 1950 and 2010 is also attached. Reduced water use generally paralleled the population decrease through the 1980's, when unaccounted for water was reportedly in the 30% range. Since the 1980's, service population continued to decline but the amount of water delivered to the system appears to have increased.

      A summary of annual water supply report data for 2005 to 2009 is attached. Average daily water use includes domestic, commercial, industrial, institutional, and bulk sales to other public water suppliers. It also includes unaccounted for water and other connections. Other is defined as water for public and municipal uses, hydrant inspections, hydrant flushing, street flushing, government usage, plant processing, etc.

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 5
TUESDAY FEBRUARY 22, 2011 @ 9:00 AM

AGENDA

1. Progress Report

   a. Development of valuations for the PWSA water and sewer systems (Task 3.1) has been initiated. System inventory information from facility site visits plus water and sewer line data extracted from the PWSA GIS system will be used to complete this task. A Replacement Cost New Less Depreciation analysis will be developed to determine system valuations. This type of analysis estimates how much it would cost to construct new facilities, and then adjusts replacement costs for individual facilities to account for their age via straight line depreciation.

   b. Additional areas of concern relative to the water system (Task 3.3) to be addressed in the 40-Year Plan will include the following:

      - WTP clearwell rehabilitation / replacement
      - Transfer pump station - Highland 2 reservoir to Highland 1 district
      - Second storage tank for Squirrel Hill pressure district
      - Low water pressure in the Penn Avenue area of Bloomfield/Garfield
      - Increasing water demands in Herron Hill pressure district
      - Safe Drinking Water Act Compliance and TTHM reduction
      - Reducing non-revenue water through leak detection and repair
      - Prioritized water main replacement program

      The need for a second water storage tank in the other pressure districts that have a single tank (Lincoln, Garfield, Herron Hill) is an item for discussion.

   c. A meeting is scheduled for Friday February 25th to discuss the existing PWSA GIS system and determine how it can be enhanced to improve system O&M activities (Task 3.8).

   d. Development of concept level cost estimates for future capital improvements in the distribution, pumping and storage, and treatment categories (Task 4.11) is also getting underway. Cost estimates will be broken down into eight five-year capital plans for use by PWSA for planning and budgeting purposes.

e. Capital improvements for the sewer category will be based on information contained in the draft CSO Feasibility Study. Activity on this item has been delayed pending PWSA approval of the draft study.

f. Review of the development of the risk-based water main replacement capital program (Task 4.2).

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 6
TUESDAY MARCH 29, 2011 @ 9:00 AM

AGENDA

1. Progress Report

   a. The Pittsburgh office of the US Army Corps of Engineers was contacted to determine if any entity holds a license to pursue hydropower at the Highland Park Lock and Dam or the Emsworth Lock and Dam (Task 3.3). Neither is currently permitted or licensed for hydropower but four firms have submitted applications at each location. A summary of the discussions, general information on the permitting process, and a table that identifies the hydropower applicants is included in Attachment A. Applicants must follow Federal Energy Regulatory Commission procedures. Available information suggests that permitting and licensing of a hydropower facility is an involved and lengthy process.

   b. During a discussion about historic water use and unaccounted for water at the January 25th Progress Meeting, it was noted that PWSA bills City of Pittsburgh customers that are served by Pennsylvania American Water Company. Monthly water billing records for the 2005 to 2010 time period were analyzed to determine water demands in this potential service expansion area. Results for the analysis are contained in Attachment B. Metered usage from 2005 to 2010 averaged 3.94 mgd. Adjusting for "unaccounted for" and "other" water uses (40 percent) results in an average water demand of 6.57 mgd for this service area. Based on measured maximum day to average day pumping rates of 1.6 for the Allentown service district, maximum day demands in the PA American service area of the City would be about 10.60 mgd.

   c. Alternative methods to reduce total trihalomethanes (TTMHs) in the PWSA system were discussed briefly at the January 4th Progress Meeting. Disinfection byproduct (DBP) control strategies include the three general approaches shown below. Alternative methods of control are listed beneath each general approach:

      1. Removal of Organic DBP Precursors
         - Enhanced coagulation
         - Peroxide / Biological Activated Carbon
         - Granular Activated Carbon in Existing Filters
         - Granular Activated Carbon in New Filters

- Granular Activated Carbon Adsorbers
- Nanofiltration
- Ozone / Biological Active Filtration
- Ozone / Biological Activated Carbon
- MIEX Ion Exchange

2. Alternative disinfectants and / or conditions
   - Chlorine dioxide
   - Ozone
   - Chloramines

3. Remove after Formation

   - Granular Activated Carbon
   - Reverse Osmosis
   - Biologically Active Carbon
   - Air Stripping

Air stripping appears to be a low cost method of reducing TTHM concentrations from water in storage facilities. A literature review indicates that aeration can remove 70 to 90 percent of TTHMs.

An Ohio water provider installed a 50 gpm recirculation pump in an elevated tank at a remote location. The pump draws water from the tank inlet/outlet and discharges it above the water surface through a spray nozzle. Operating results since the system was installed show a 70 to 80 percent TTHM reduction. Aeration also appears to have little to no effect on chlorine residuals. The cost for the pump, piping, and accessories was reported to be $2,500 and it costs about $800 per year to run the 2 HP pump continuously from April to November. Equipment installation was done by water department staff.

Attachment C contains information about the Air-Max Oxygen Injector System. This system is specifically designed to be placed into potable water tanks for the purpose of mixing, circulating, and injecting oxygen into the drinking water to reduce DBPs. The self contained unit consists of a stainless steel pump motor and intake screen, flexible PVC tubing, underwater power cord, and a fiberglass float / air intake that supports the motor and suspends the discharge nozzles just below the water surface. The oxygenated plumes of water exiting the discharge nozzles remove DBPs from the water through volatilization. The system can be installed in water tank through a 30-inch opening and costs about $3,000. Information on the system is available at the following web site:

http://drinkingwateraerator.com/

d. Work on system valuations (Task 3.1) began this month. Information about PWSA treatment, pumping, and storage facilities was collected as part of the system inventory / pumping and treatment inventory tasks. Water distribution system and sewer system data was taken from the PWSA GIS. The GIS contained information on installation dates for some water and sewer system components. Estimated ages for waterlines and valves were determined by cross referencing GIS data with information from record books and calc books. Summary water and sewer system information from this analysis is included in Attachment D. Water and sewer summary statistics are listed below:

- 1,012 miles of 1 to 120-inch waterlines
- 25,375 valves
- 7,558 hydrants
- Oldest pipes and valves date back to 1887
- 1,211 miles of 3 to 168-inch sewers
- 29,084 manholes
- 24,143 inlets / catch basins
- 99 diversion structures

PWSA uses the following for the useful lives of facilities:

- 70 years for water and sewer lines
- 40 years for plant facilities
- 25 years for boilers, floating reservoir covers, tank painting

Useful live figures will be used to depreciate assets during preparation of the system valuations. A 70-year useful life for pipelines means that waterlines installed before 1941 will have zero value. Based on the actual and estimated ages for water system components, more than 50 percent of the waterlines and valves fall into this category.

e. Development of concept level cost estimates for recommended capital improvements (Task 4.11) continued this month. Historic records are being reviewed to determine typical time intervals between facility upgrades for use in projecting dates for future projects. The table in Attachment E lists ages for PWSA treatment, pumping, and storage facilities. Although the facilities have been rehabilitated and upgraded over time, a quarter of the items on the list are more than 100 years old and ages for 80 percent of the items exceed the 40 year useful life for plant facilities. DeLaval and Allis Chalmers pumps at the Ross, Bruecken, Mission, and Lincoln pump stations are original units that have been rebuilt numerous times.

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
PROGRESS MEETING NO. 7
TUESDAY APRIL 26, 2011 @ 9:00 AM

AGENDA

1. Progress Report

   a. Work on system valuations (Task 3.1) continued in April. Water distribution system and sewer system information was taken from the PWSA GIS. Costs for these components will be estimated using information from the 2011 edition of R.S. Means Heavy Construction Cost Data.

      Costs for new water storage tanks were estimated using information from the 2011 edition of R.S. Means Heavy Construction Cost Data. Estimated foundation costs were added to the tank costs and the total estimated project cost for each storage facility included a construction contingency and an allowance for engineering and other project costs. New tank cost estimates are included as Attachment A.

      Costs for in-ground reservoirs are being estimated based on the original cost for the Lanpher reservoir. The article in Attachment B describes design and construction of the Lanpher Reservoir. The project was awarded in July 1912 at a cost of $681,976. The original construction cost was trended to April 2011 price levels using the Engineering New-Record Construction Cost Index (ENRCCI). The cost for a floating cover is being estimated based on bid prices for the Highland No. 2 Floating Cover Replacement Project.

      Development of system valuations for pumping and treatment facilities is underway. Costs for new booster pump stations are being estimated using information from the March 2011 low bid price received for a booster pump station that Chester Engineers designed for a western Pennsylvania client. A unit cost per square foot has been developed to cover building costs. The cost for new pumps will be added to the building cost along with an allowance for piping, valves, and accessories. These components typically account for about 80 percent of the cost for pumping facilities. Electrical work makes up another 12 percent of the total, while general requirements and site work round out the total. Total estimated costs for new pump stations will also include a construction contingency and a project cost allowance.

   b. Development of concept level cost estimates for recommended capital improvements (Task 4.11) continued this month. Historic records were reviewed to determine typical time intervals between facility upgrades for use

in projecting dates for future projects. Attachment C contains a schedule for recommended capital improvements to storage facilities, as well as concept level cost estimates for recommended capital improvements.

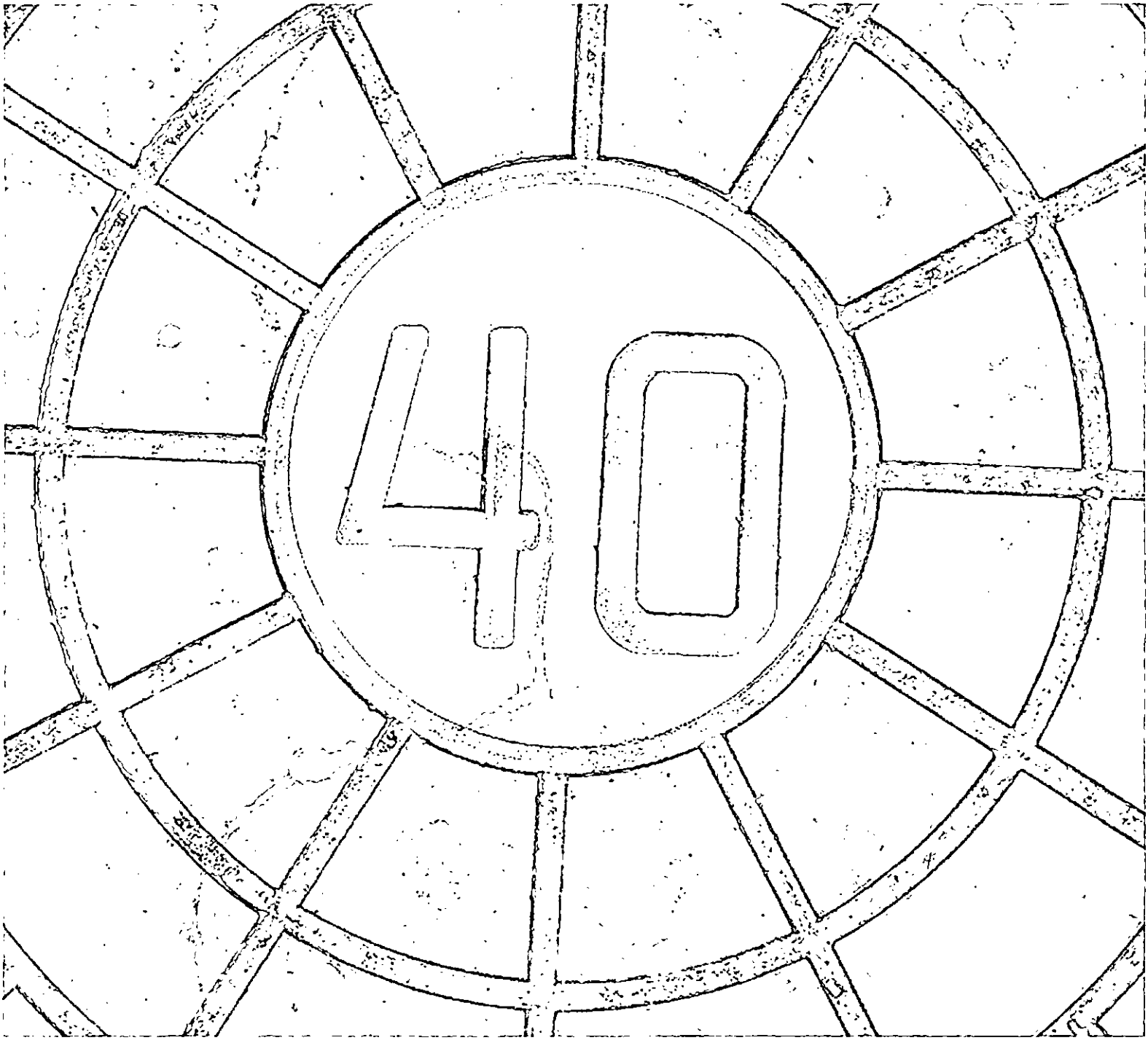
Similar schedules and cost estimates are being developed for distribution, pumping and treatment improvements.

On the sewer side, Chester has been working with PWSA staff to go through the Draft Feasibility Study and identify recommended improvements needed for PWSA to control overflows from the CSO outfalls that are permitted to PWSA only. Improvements are sized so that CSOs discharge 4 times or fewer during a typical year and so that conveyance facilities have capacity to carry peak flows from a 2-year design storm. Construction cost estimates are being developed using the ALCOSAN ACT cost estimating tool.

A much larger set of CSOs are jointly permitted to both ALCOSAN and PWSA. ALCOSAN will be responsible for controlling flows from the jointly permitted outfalls. PWSA will not absorb any direct capital costs for these improvements but will share in these costs with other ALCOSAN customers.

Improvements to PWSA sewage pump stations will be based on upgrades being made to all four pump stations. The Mifflin Road and Rodgers Street pump stations in Lincoln Place could be eliminated by constructing short gravity sewer extensions and allowing the wastewater to be treated by the West Mifflin Sanitary Sewer Municipal Authority. Discussions have been held between PWSA and West Mifflin to work out the details but this change cannot happen without ALCOSAN approval.

APPENDIX 1-3



APPENDIX 1-3
PROGRESS MEETING MINUTES

The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Progress Meeting No. 3
Tuesday, January 4, 2011, PWSA Training Room
Meeting Minutes

Attendees: PWSA – Bob Hutton, Jeff Lenner, Tom Palmosina, Steve Simcic, Stanley States, Thomas Gigliotti
Chester Engineers – Charlie Jordan, John Maslanik, Michael McKee

Meeting Handouts and Attachments

1. Agenda
2. Draft System Inventory Spreadsheet
3. Draft Pumping and Treatment Inventory Spreadsheet
4. Examples of TTHM Removal via Air Stripping – City of Surprise, Arizona; Las Vegas, Nevada; and Sandusky, Ohio
5. Figure Showing Total Projected Population Change Through 2046
6. Figure Showing Projected Population Change by Acre Through 2046

Items Discussed

1. Progress Report
   a) Meetings with City and County Planning Department, Allegheny County Health Department, and Pennsylvania Department of Environmental Protection to be held in January 2011. Charlie Jordan will forward the schedule so that interested PWSA staff can attend meetings. Stanley States indicated that he would like to attend the meetings with ACHD and DEP.

   b) System Inventory and Pumping and Treatment Inventory spreadsheets are being finalized during the week of January 3rd based on information collected during site visits in December 2010 to the treatment plant, water pump stations, water storage facilities, and sewage pump stations. The draft spreadsheets that were attached to the agenda will be updated with information from the site visits.

   c) Removal of total trihalomethanes (TTHMs) from water storage facilities via air stripping appears to be a promising alternative to reduce TTHMs produced as disinfection by-products. Stanley States indicated that PWSA has taken steps through the years to minimize TTHM formation by trying alternative disinfectants (chlorine dioxide), optimizing the treatment process, and changing chlorine application points. He also mentioned problems that other water systems (West View Water, Washington D.C.) have had with lead violations after changing disinfectants. PWSA is currently working with a vendor to get bubbler systems installed in a few water storage tanks to

evaluate the effectiveness of air stripping in TTHM removal. This program is being undertaken with Dr. Casson at the University of Pittsburgh.

d) Work continued on the analysis of water main break data for the purpose of generating main break frequency statistics for the water main replacement program. John Maslanik stated that main break data from 1990 has been assembled from SAP and calc books, so 20 years of break information will be available for the analysis. Bob Hutton stated that PWSA has developed a rating or scoring system used to determine which pipes to replace. Chester will assess the feasibility of incorporating the rating system into the main replacement program if PWSA provides information on this subject. Bob Hutton also mentioned that leadite was used in the PWSA system for about 15 years – from the mid-1940's to the 1960's. Known problem areas that correspond to the leadite years are good candidates for pipe replacement. There is limited information available regarding the Millvale system but any main break data for Millvale can be included in the model.

e) Population changes in the PWSA system have been developed using population projections from the Southwest Pennsylvania Commission. This information will be used in the water model to reflect future water demand conditions.

f) There are two action items. Chester Engineers needs any PWSA internal questionnaires that have not yet been returned. Chester also has to complete a discussion paper regarding how water and sewer system regionalization has been accomplished in other parts of the United States.

2. Reserve Township and Millvale Systems

a) A waterline agreement is currently being negotiated with Reserve Township to construct a link to the Millvale system. Most of the pipelines in the Reserve Township water system are dead ends and the connection with Millvale will improve flow characteristics in the Township.

b) A sewer agreement is also being discussed with Reserve Township.

c) PWSA needs to inspect the Millvale tank. This elevated tank was built by Millvale but was never placed into service. The tank couldn't be filled because the pipelines in the system couldn't handle the pressure.

3. 2010 PWSA Inspection Reports

a) Mark Mellott has completed his annual inspection reports for PWSA facilities. Charlie Jordan will forward this information to PWSA.

4. Next Meeting
   a) Tuesday, January 25, 2011 at 9:00 AM.

Please submit any corrections or additional comments to these meeting minutes to me at cjordan@chesterengineers.com. Comments must be submitted by January 22, 2011.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Progress Meeting No. 4
Tuesday, January 25, 2011, PWSA Training Room
Meeting Minutes

Attendees: PWSA – Tom Gigliotti, Bob Hutton, Jeff Lenner, Rick Obermeier, Stanley States, *Don Waldorf*
Chester Engineers – Charlie Jordan, John Maslanik, Michael McKee

Meeting Handouts and Attachments

1. Agenda
2. List of Local Agencies and Contacts for Meetings Regarding Potential Expansion of the PWSA Service Area
3. Draft Discussion Paper on Water and Sewer System Regionalization
4. System Inventory Final Spreadsheet
5. Pumping and Treatment Inventory Final Spreadsheet
6. Summary of Water Audit Results
7. Analysis of Water Use and Service Population Trends From 1950 to 2010
8. Summary of Annual Water Supply Report Data From 2005 to 2009
9. Chart Showing Main Break Frequency (1989 to 2010) Versus Age of Pipe

Items Discussed

1. Progress Report
   a) The list of local agencies and contacts for meetings about potential expansion of the PWSA service area was presented. Don Waldorf commented that other private developers, such as Walnut Capital, could be included on the contact list in addition to The Buncher Group.

   b) The draft discussion paper on water and sewer system regionalization was summarized, including two cases where cities in Illinois attempted to use eminent domain to purchase the assets of an adjacent investor-owned utility.

   c) Final System Inventory and Pumping/Treatment Inventory spreadsheets were presented. Tom Gigliotti suggested that the information in the Pumping and Treatment Inventory should be broken down into major equipment categories rather than being ordered by facility. It was also suggested that the sewage pumping stations be separated from the water facilities.

   d) The results of the draft water audit study by HDR Engineering were summarized. The main finding of the study is that the majority of the venturi meters in the PWSA system do not meet AWWA accuracy standards. Tom Gigliotti discussed some of the meter problems. Venturi meters need to be installed properly and then calibrated and maintained to provide accurate readings. The flow signal for a venturi meter is based on a differential

pressure reading. Tom Gigliotti is trying to get HDR to finish up the water audit, which was started in 2005/2006.

e) An analysis of water usage and service population trends from 1950 to 2010 was presented. Reduced water use generally paralleled population decreases through the 1980's, when unaccounted for water was reportedly in the 30% range. Since the 1980's, service population continued to decline but the amount of water delivered to the system appears to have increased. Unaccounted for water and "other" uses are the two largest components of PWSA water use. Based on the apparent historic relationship between water use and service population, it is not clear how much water is available for future expansion of the service area. PWSA staff feels that the system has plenty of treatment and storage capacity but that additional pipelines and some additional pumping capacity would be needed to serve the South Hills. PWSA bills the customers in portions of the City that are currently served by Pennsylvania American Water Company.

f) A chart showing main break frequency versus age of pipe was presented and discussed. The chart was based on main break data from 1989 to 2010. This analysis shows that pipelines with the highest incidence of breaks were installed in the 1940's and 1950's when leadite was used as a construction material. Leadite was used during World War II due to a shortage of lead and was phased out in the mid 1950's. Other factors that impact main breaks are the pipe size, material of construction, and soil corrosivity.

2. Action Items

a) Chester Engineers requests billing data for City water customers that are served by PA American to assist in determining water demands for this potential expansion area.

b) Chester Engineers requests copies of annual water supply reports for 2010 and for the period from 1991 to 2004 for use in analyzing historic water usage and unaccounted for water.

3. Next Meeting
   a) Tuesday, February 22, 2011 at 9:00 AM.

Please submit any corrections or additional comments to these meeting minutes to me at cjordan@chesterengineers.com. Comments must be submitted by February 12, 2011.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Progress Meeting No. 5
Tuesday, February 22, 2011, PWSA Training Room
Meeting Minutes

Attendees: PWSA – Tom Gigliotti, Bob Hutton, Jeff Lenner, Rick Obermeier, Tom Palmosina, Stanley States, Don Waldorf
Chester Engineers – Charlie Jordan, John Maslanik, Michael McKee

Meeting Handouts and Information

1. Agenda
2. Powerpoint Presentation on the Risk-Based Water Main Replacement Capital Program

Items Discussed

1. Progress Report

   a) Valuations for the PWSA water and sewer systems (Task 3.1) have been initiated and will be developed using a Replacement Cost New Less Depreciation analysis. System inventory information from the facility site visits plus water and sewer line data extracted from the PWSA GIS system will be used to complete this task.

   b) Additional areas of water system concerns (Task 3.3) to be addressed in the 40-Year Plan will include the following:

      - WTP clearwell rehabilitation / replacement
      - Transfer pump station - Highland 2 reservoir to Highland 1 district
      - Second storage tank for Squirrel Hill pressure district
      - Low water pressure in the Penn Avenue area of Bloomfield/Garfield
      - Increasing water demands in Herron Hill pressure district
      - Safe Drinking Water Act Compliance and TTHM reduction
      - Reducing non-revenue water through leak detection and repair
      - Prioritized water main replacement program

   Two parallel studies were prepared for the WTP clearwell and Dennis Graham was involved with both studies. The 40-Year Plan should include costs for the most reasonable option. The estimated cost for clearwell rehabilitation is $100 million.

   The clearwell is over 100 years old. PWSA is working with Dennis Graham on an emergency operation plan to address potential problems with the

clearwell. The purpose of the operation plan is to identify how water would get from the treatment plant to the system if the clearwell collapsed.

PWSA is investigating a transfer pump station to send water from Highland 2 reservoir to the Highland 1 district. A potential location for the pump station is at the toe of the slope of Highland 2 reservoir, near the 50-inch main.

The Squirrel Hill tank is scheduled to be painted this year but will be difficult to take out of service. Stanley States suggested that the tank should be isolated so that KTA can assess the tank condition prior to painting. If the inspection reveals that the tank is nearing the end of its useful life, the tank should be replaced. The Squirrel Hill tank is a standpipe but should really be an elevated tank because the water in the bottom of the tank is of no use. If the water level drops below a certain level, part of the service area loses pressure. A second Squirrel Hill tank would take a load off the Herron Hill reservoir. Options for Squirrel Hill would be to add a second tank or replace the existing standpipe with an elevated tank. The 40-Year Plan should recommend the best alternative.

Low water pressure in the Bloomfield/Garfield area could be addressed by changing the boundary of the Bloomfield regulator. However, this action would increase demand in the Herron Hill pressure district. The Garfield Tank already experiences a lot of use and turns over two times a day.

Increasing water demands in the Herron Hill district could be eased by construction of a second Herron Hill pump station near Boundary Street. The station could take water from a 50-inch transmission main and the pump discharge could tie into distribution mains nearby. This station would add flexibility and capacity to the system, would serve as a backup for the existing Herron Hill pump station, and could provide service from Highland 1 or Highland 2.

An experimental aeration system is being installed in the Brashear Tank to address TTHM issues. The Squirrel Hill tank also has problems with TTHMs and will need a similar system.

The 40-Year Plan needs to address the potential for serving the portion of the City currently serviced by PA American. The facilities needed to provide service will have to be in place if PWSA takes over service to the South Hills. PWSA currently has the 40 Acres area in the South Hills but the area is more like 100 acres in size. There will need to be a lot of re-adjustment if PWSA takes over service to the South Hills. The major problem in evaluating service to this area is that we don't know anything about the PA American distribution system in the South Hills except that PA American has storage tanks in Greenfield and Lincoln Place. Chester Engineers previously estimated the amount of water that would be needed to serve the South Hills

area. Upon further review, this analysis overestimated the demand. Lower demand will have less impact on the PWSA system than the original analysis.

Another item to be added to the 40-Year Plan is rehabilitation of the access tunnel at the water treatment plant. This tunnel passes under old Route 28 and the railroad tracks and provides emergency access to the plant site. The tunnel is over 100 years old and will need to be rehabilitated in the next 40 years.

c) A meeting is scheduled for Friday February 25 to discuss the existing PWSA GIS system and determine how it can be enhanced to improve system O&M activities. Chester GIS personnel will confirm the meeting date and time with Bob Hutton.

d) Development of concept level cost estimates for future capital improvements in the distribution, pumping and storage, and treatment categories (Task 4.11) is also getting underway. Dennis Graham and Mark Mellott will be involved with this activity since they are the Chester employees who are most knowledgeable about past and planned future capital improvements.

e) Capital improvements for the sewer category will be based on information contained in the draft CSO Feasibility Study.

The draft Feasibility Study recommends taking more water to the ALCOSAN interceptors in order to limit discharges from the PWSA system to 4 overflows per year at each CSO. This approach will involve building larger pipes to transport the flows to ALCOSAN. There are 40 PWSA CSOs and 145 ALCOSAN diversion chambers.

Don Waldorf feels that separating sewers would be a lower cost alternative and recommended that costs for sewer separation should be developed and compared to the costs for installing larger pipes.

The 4 overflow per year criteria has been established for 25 years. If the system repairs needed to meet this standard are determined to be unaffordable, then the regulatory agencies can be lobbied to allow more overflows per year.

Chester has modeled the PWSA system to develop pipeline quantities needed to address the CSO issues. Costs for the feasibility study recommendations have been estimated using the ALCOSAN cost estimation tool. Chester is in the process of costing out sewer separation in 9 or 10 drainage areas where this is an issue. PWSA and Chester are working to get this situation resolved by April. The cost estimate information from this analysis will be used in the 40-Year Plan.

f) Powerpoint Presentation on Risk-Based Water Main Replacement Program

The water main replacement program uses the likelihood of failure and consequences of failure to calculate the risk of pipeline breaks. The likelihood of failure is based on historic water main break records, approximately 5,200 breaks since 1989. Street addresses for main breaks were available in SAP. GIS was used to geolocate and assign each break to a water main segment. Findings from the main break analysis include the following:

- Break frequency is highest for pipes installed between 1940 to 1950, when leadite was used as a construction material because of a lead shortage during World War II.

- 15-inch pipe has a high break frequency. This may be due to a combination of two factors, a small quantity of 15-inch lines in the system and very old pipe.

- Smaller pipes are more prone to breaks. Tom Gigliotti suggested that the higher incidence of breaks in small lines may be influenced by water hammer.

Don Waldorf asked why the incidence of main breaks was also elevated during the period from 1930 to 1940 since leadite was not used until some time in the 1940's. Chester will review the data and try to determine a reason for this finding.

Consequences of failure are evaluated by identifying factors such as critical mains and critical users. Critical mains are those in which a break would curtail service to large numbers of customers and/or would cause major traffic disruptions. The software program identifies valves that would need to be closed to isolate pipe segments in the event of a break. Critical users would include hospitals and other PWSA identified users.

PWSA staff suggested that critical facilities should include hospitals, the downtown central business district, schools/universities, the north shore area between the stadiums and the state prison (just south of the ALCOSAN treatment plant), and rising mains.

Potential fire flow improvements can be made in areas that exhibit poor hydrant flow results. In these areas, pressures and fire flows could be significantly improved by replacing existing 6-inch lines with 8-inch diameter pipes.

Don Waldorf suggested that the main break replacement program be expanded to include the Millvale water system since PWSA is now responsible for operation and maintenance of the system.

Chester Engineers will investigate how the rate of water main breaks has varied over time. Chester will also identify the total length of line by pipe diameter for the three identified categories with the highest incidence of breaks.

2. Action Items

   a) Chester Engineers has requested sewer system information from the PWSA GIS system for use in the system valuation analysis.

3. Next Meeting
   a) Tuesday, March 29, 2011 at 9:00 AM.

Please submit any corrections or additional comments to these meeting minutes to me at cjordan@chesterengineers.com. Comments must be submitted by March 11, 2011.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Progress Meeting No. 6
Tuesday, March 29, 2011, PWSA Training Room
Meeting Minutes –REVISION (4/25/11)

Attendees: PWSA – Tom Gigliotti, Bob Hutton, Jeff Lenner, Rick Obermeier, Stanley States, Don Waldorf
Chester Engineers – Chuck Brence, Charlie Jordan, John Maslanik, Michael McKee

Meeting Handouts and Information

1. Agenda
2. Attachment A – Hydropower Information
3. Attachment B – Metered Water Use for City Customers Served by PA American
4. Attachment C – Information on Air-Max Oxygen Injector System
5. Attachment D – Summary Water and Sewer System Information
6. Attachment E – Ages for PWSA Treatment, Pumping, and Storage Facilities

Items Discussed

1. Progress Report

   a) The Pittsburgh office of the US Army Corps of Engineers was contacted to determine if any entity holds a license to pursue hydropower at the Highland Park Lock and Dam or the Emsworth Lock and Dam. Neither dam is currently permitted or licensed for hydropower but four firms have submitted applications at each location. Applications for Highland Park range from 10 to 16 megawatt (MW) capacity while the Emsworth applications range from 31 to 36 MW.

   PWSA had a license for hydropower in the past but it expired. Reports on generating hydropower were prepared for PWSA in the early 1990s. The current annual electric bill for PWSA is approximately $5.5 million. PWSA staff feels that an application should be submitted to generate hydropower at the Highland Park dam. Wind power should also be investigated as a potential source of power for PWSA. There is a restaurant across the street that has a cylinder-type windmill to generate power. Cylinder-type units reportedly do not harm birds and bats. The area by the clearwell would be a good location for wind power.

   b) Water billing records for City customers served by PA American water were analyzed from 2005 through 2010 to determine water demands in this potential service expansion area. Metered usage during this period averaged about 4.00 mgd. There were approximately 24,600 customers in this service

area during 2010. Adjusting for "unaccounted for" and "other" water uses results in an average water demand of 6.60 mgd for this area. The maximum day demand for the PA American service area of the City would be about 10.60 mgd based on the 1.60 peaking factor that is experienced in the Allentown service district.

Several PWSA staff members felt that the number of customers and metered water demand seemed low in the portion of the City served by PA American. However, this information was determined from PWSA billing records. PWSA provides sewer service to all City residents and water service to approximately 75 percent of the residents. There are currently about 80,000 metered water connections in the PWSA service area. Adding the 24,600 customers served by PA American results in about 105,000 total metered connections in the City. The 80,000 water customers served by PWSA is consistent with the 75 percent estimate above, representing about 76 percent of total customers in the City.

c) Control strategies and alternative methods to reduce total trihalomethanes (TTHMs) in the PWSA system were discussed. Air stripping appears to be a low cost method of reducing TTHM concentrations from water in storage facilities. The maximum contaminant level (MCL) for TTHMs is 80 micrograms per liter (ug/L). TTHM concentrations in the PWSA system are generally in the high 60s but concentrations in Reserve Township are close to the 80 ug/L limit. PWSA is currently meeting Stage 1 requirements for TTHMs but Stage 2 will require sampling at 12 sites instead of 4 and a running average will no longer be used to determine the TTHMS. Each site must be below the MCL of 80 ppb. Mandatory testing will begin in April 2012. Stanley States feels that 20 percent TTHM removal would probably allow PWSA to meet the requirements for Stage 2 but there will be violations if TTHM levels can't be reduced at the storage tanks.

PWSA has undertaken numerous steps to reduce TTHM concentrations in finished water. These steps include eliminating pre-chlorination of the raw water entering the treatment plant, lowering turbidity to reduce total organic carbon (TOC), practicing enhanced coagulation, decreasing the amount of stored water to reduce water age, and optimizing the system. A small amount of chlorine is added just before the filters to remove manganese.

A flushing program is another method that can be used to reduce TTHMs. Automatic flushers can be installed on fire hydrants to bleed water from dead end lines. PWSA doesn't have a flushing program at the present time. Another way to reduce TTHMs would be to install a UV disinfection system at the treatment plant and use less chlorine. PWSA can't use an alternative disinfectant such as chloramines because a corrosion inhibitor can't be added to the water due to the open Highland Park No. 1 reservoir. Without a corrosion inhibitor, the use of chloramines would cause lead violations.

PWSA is working with PAX Technologies and Dr. Casson at the University of Pittsburgh to install a demonstration system at the Brashear tanks. The Brashear tanks are located near the sampling point that has the highest measured TTHMs. One of the two tanks was painted recently and is still off-line. The demonstration system will be installed in this tank. PWSA plans to sample the water entering and exiting the tank at two week intervals to determine what kind of TTHM reductions are possible with the PAX system. The collected data will be published in a paper at the end of the study. Stan States said that other than the PAX process, no other major changes will be made to the system and that PWSA must now optimize the system to reduce the growth the TTHMs.

The PAX demonstration systems need to be put into place ASAP. Additional vents may have to be added on the top of the tank to provide the required amount of air exchanges for the system. Both Brashear tanks are currently equipped with Red Valve systems to prevent stratification. The PAX system will add a mixer.

d) Work on system valuations began in March. Information from the GIS indicates that more than 50 percent of the water lines in the PWSA system are older than 70 years, which is the figure that PWSA uses for the useful life of a water or sewer line. Useful life figures will be used to depreciate assets during the preparation of the system valuations, which means that water lines older than 70 years will have zero value. From a system management standpoint, assets that have exceeded their useful lives need to be replaced.

PWSA staff noted that a very small percentage of PWSA water lines have been replaced in recent years. The URA installs a lot of new water lines as part of their projects. Stanley States noted that Cincinnati completed a program to reline or replace all of the water lines in their system over a 30-year period. Tom Gigliotti requested that Chester review data for other cities to see how many waterlines are being replaced in other areas of the country and to determine a typical replacement rate (percent per year).

PWSA staff recommended that a lead service line replacement program be included in the 40-year plan. There are no statistics on the number of lead service lines in the PWSA system. Any program needs to include replacement of the entire service line from the main to the house because replacing part of a lead line sometimes makes things worse (higher lead levels than if nothing is done). PWSA could replace the lead service line from the main to the property line if the property owner agrees to replace the service line from the property line to the house. There is also no point in replacing a lead service line if there is still lead pipe within a home.

e) Development of concept level cost estimates for future capital improvements continued in March. Although PWSA facilities have been rehabilitated and upgraded over time, ages for 80 percent of PWSA treatment, pumping, and storage items exceed the 40 year useful life for plant facilities. DeLaval and Allis Chalmers pumps at four of the pump stations are original units that have been rebuilt or rehabilitated numerous times. Tom Gigliotti commented that is difficult to find people to repair and rebuild these pumps. Bearings and spare parts are not readily available and there are few companies left that can fabricate parts. The 40-Year Plan should include replacement costs for the older pumps.

f) The 40-Year Plan will include a recommendation that a floating cover be installed on the Highland No. 1 reservoir. Although the reservoir has a capacity of 130 million gallons, the amount of useable water is limited to the capacity of the membrane filtration plant plus the water stored in tanks within the service district. As a result, the Highland No. 1 reservoir is a bottleneck in the PWSA system. It is also a potential target for a terrorist attack on the City's water supply. PWSA staff indicated that it was a political issue to leave the reservoir uncovered. This subject was discussed back in the 1990's and the decision was made to leave the reservoir uncovered. Local residents walk around the reservoir and like the appearance of the open water. The membrane treatment plant went into operation in 2002 and was rehabilitated in 2010. Tom Gigliotti indicated that it costs $40,000 per month to run the membrane plant.

g) Tom Gigliotti and Jeff Lenner indicated that they would be interested in attending the meeting with the local agencies (DEP, ACHD, City and County Planning departments).

2. Next Meeting

a) Tuesday, April 26, 2011 at 9:00 AM.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

The Pittsburgh Water and Sewer Authority
40 – Year Capital Plan, PWSA Project R-D1.10015-11
Progress Meeting No. 7
Tuesday, April 26, 2011, PWSA Training Room
Meeting Minutes

Attendees: PWSA – Tom Gigliotti, Bob Hutton, Jeff Lenner, Tom Palmosina, Stanley States, Don Waldorf
Chester Engineers – Charlie Jordan, John Maslanik, Michael McKee

Meeting Handouts and Information

1. Agenda
2. Attachment A – Cost Estimates for New Water Storage Tanks
3. Attachment B – Article on Lanpher Reservoir, Floating Cover Cost Estimates
4. Attachment C – Schedule and Cost Estimates for Storage Improvements

Items Discussed

1. Progress Report

   a. Work on system valuations (Task 3.1) continued in April. Water distribution system and sewer system information was taken from the PWSA GIS. Costs for these components will be estimated using unit cost data from the 2011 edition of R.S. Means Heavy Construction Cost Data.

      Costs for new water storage tanks were estimated using information from the 2011 edition of R.S. Means Heavy Construction Cost Data. The total estimated project cost for each storage facility includes a construction contingency and an allowance for engineering and other project costs. Tom Gigliotti said that PWSA (Anthony Teti) has recent budget quotes for the Herron Hill tank.

      Costs for in-ground reservoirs are being estimated based on the original cost for the Lanpher reservoir, trended to 2011 price levels. The cost for a floating cover is being estimated based on bid prices for the Highland No. 2 Floating Cover Replacement Project.

      Development of system valuations for pumping and treatment facilities is underway. Costs for new booster pump stations are being estimated using information from the March 2011 bid price received for a booster pump station that Chester Engineers designed for a western Pennsylvania client. The estimated cost for each station will be adjusted based on the area of the building and the cost for new pumps and piping. Total costs for pump stations will include a construction contingency and a project cost allowance.

b. Development of concept level cost estimates for recommended capital improvements (Task 4.11) continued this month. Historic records were reviewed to determine typical time intervals between facility upgrades for use in projecting dates for future projects. Stanley States noted that the Highland No. 1 reservoir needs to be cleaned and a new liner should be installed. The reservoir was last cleaned in 1982 and the liner was installed at that time. A dividing wall is also needed to provide redundancy. Tom Gigliotti suggested that $4 to $5 million be allocated to fix the parapet wall, install a new liner, and re-install the railing around the reservoir.

Similar schedules and cost estimates are being developed for distribution, pumping and treatment improvements. Tom Gigliotti indicated that the Aspinwall treatment plant needs a polishing step to remove substances such as medical wastes and bromides. Costs for future treatment improvements should be included as a placeholder in the 40-Year Plan. Stanley States felt that future treatment plant improvements should include membrane filtration and UV disinfection, in addition to the required clearwell improvements. Don Waldorf pointed out that the access tunnel to the Aspinwall plant, which passes under old Route 28, needs to be rehabilitated.

John Maslanik stated that costs for a solution to low pressure in the Bloomfield area (changing the boundary of the Bloomfield regulator) will be included in the 40-Year Plan.

Chester has been working with PWSA staff to go through the Draft Feasibility Study and identify recommended improvements needed for PWSA to control overflows from the CSO outfalls that are permitted to PWSA only. Construction cost estimates are being developed using the ALCOSAN ACT cost estimating tool. A larger set of CSOs are jointly permitted to both ALCOSAN and PWSA. PWSA will not absorb any direct capital costs for these improvements but will share in these costs with other ALCOSAN customers.

Improvements to PWSA sewage pump stations will be based on upgrades being made to all four pump stations. The Mifflin Road and Rodgers Street pump stations in Lincoln Place could be eliminated by constructing short gravity sewer extensions and allowing the wastewater to be treated by the West Mifflin Sanitary Sewer Municipal Authority. However, ALCOSAN will not approve this change because it does not want to lose the sewer customers. Tom Gigliotti suggested that $3 million be allocated for station upgrades.

Dye testing identified 163 PWSA catch basins that are connected to sanitary sewers and need to be disconnected per COA requirements. Most of these catch basins were constructed to eliminate puddles in the street that people complained about. Some of the catch basins may be able to be daylighted but others will require storm sewer construction to handle the flows.

Don Waldorf said that PWSA should not build any storm sewers to disconnect catch basins unless Public Works is already re-paving the road. Tom Gigliotti will send a letter to Public Works to get the paving schedule for this year.

John Maslanik asked how much money should be allocated to disconnect catch basins since the cost to disconnect a storm inlet will be site specific. Don Waldorf stated that PWSA should not spend more than $5,000 to $10,000 to disconnect a catch basin from the sanitary sewer system. Bob Hutton said PWSA has a map of the 31st Ward that identifies catch basins that failed a dye test and are connected to sanitary sewers. The map will be analyzed to develop a unit cost for catch basin disconnections that can be used in the 40-Year Plan. Don Waldorf feels that a storm water authority is needed to fund these types of improvements.

The end date for CSO related work is 2026. The PWSA CSO plan must be finalized next year. The 40-Year Plan will assume sewer design and planning activities starting in 2013 and a 10-year construction period beginning in 2017.

Tom Gigliotti feels that PWSA needs to accelerate efforts to reduce water losses as part of the 40-Year Plan.

c. Chester Engineers requested an extension for completion of the draft report from May 11 to May 31.

2. Next Meeting

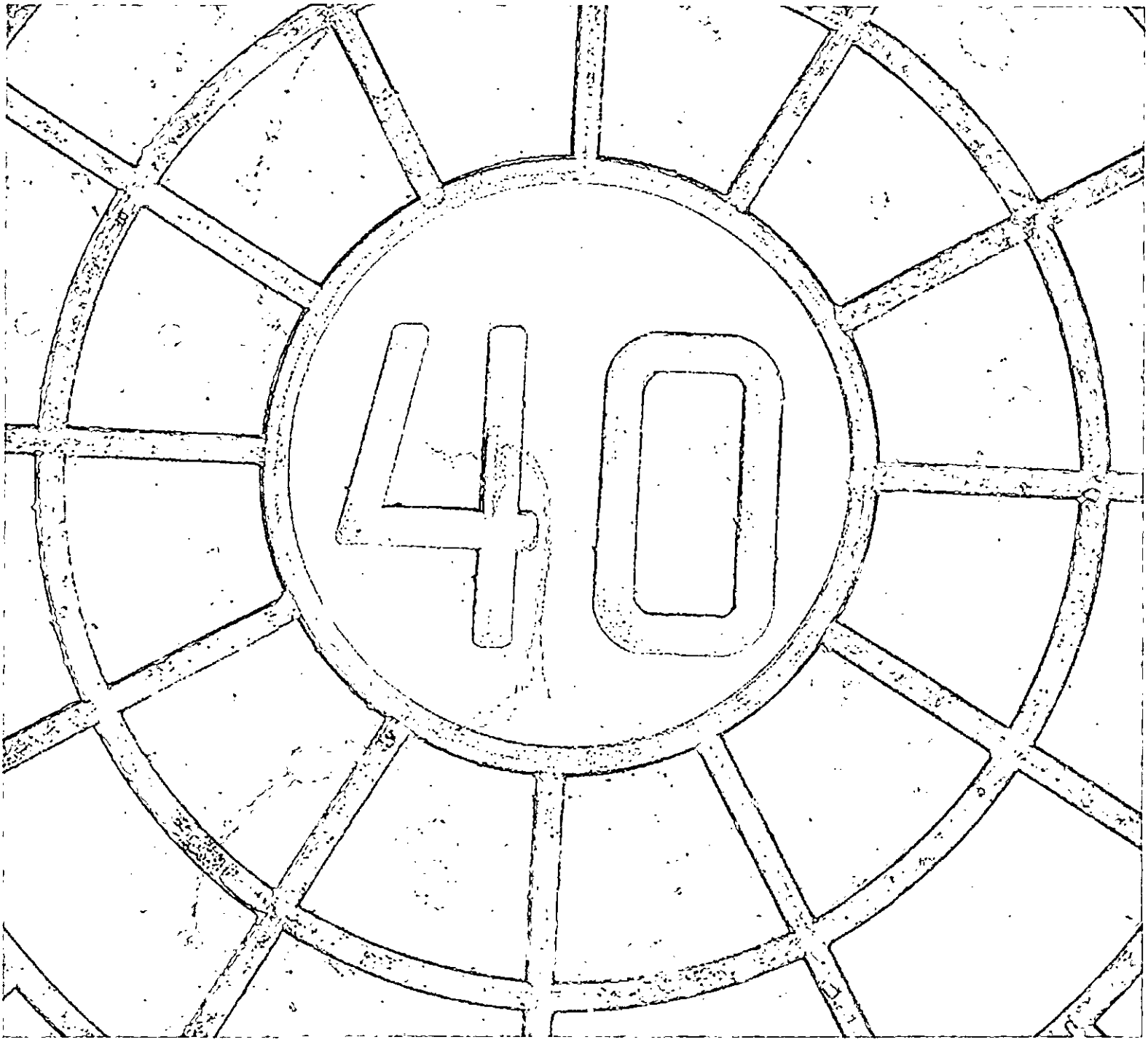
a) To be scheduled after PWSA review of the draft 40-Year Plan.

Please submit any corrections or additional comments to these meeting minutes to me at cjordan@chesterengineers.com. Comments must be submitted by May 16, 2011.

Respectfully submitted,

Charles J. Jordan, P.E.
Project Manager

APPENDIX 1-4



APPENDIX 1-4
INTERNAL QUESTIONAIRE MEETING AGENDA AND COMPLETED QUESTIONAIRES

THE PITTSBURGH WATER AND SEWER AUTHORITY
40-YEAR CAPITAL PLAN
PWSA PROJECT NO. R-D1.10015
INTERNAL QUESTIONNAIRE MEETING
FRIDAY OCTOBER 29, 2010 @ 11:00 AM

AGENDA

1. Introductions
2. Purpose of Internal Questionnaire
3. Water System Critical Problems and Needs
4. Sewer System Critical Problems and Needs
5. Target Levels of Service for Acceptable System Performance
6. Other Problems and Needs
7. Discussions

PWSA 40-Year Capital Plan
Internal Questionnaire

PWSA is beginning the preparation of a 40-Year Capital Plan. The plan will include needs assessments to identify the future improvements required to maintain and enhance the performance of the existing water and sewer systems. The plan will also investigate opportunities for system expansion through regionalization or PWSA acquisitions.

The purpose of this questionnaire is to obtain input from PWSA department heads and other key staff members on items that need to be addressed in the 40-Year Capital Plan. Your participation in the planning process is vital component in charting the future direction of the Authority. Therefore, we ask that you fill out the following questionnaire. We plan to use the results of your initial input through this questionnaire as an initial starting point and basis for future discussions to insure that we capture and consider your specific concerns. If you have any questions or comments regarding this questionnaire, please contact Mike McKee of Chester Engineers at 412-809-6623 or mmckee@chesterengineers.com.

Name of Person Completing Questionnaire Tom Palmosina
Telephone Number _____
e-mail address _____

1. Please list and provide below or on separate sheets brief descriptions of what you consider to be the most critical problems/most pressing needs facing the PWSA water system? Please rank by importance. As a point of reference, we identified the following major water system issues in our proposal. They are presented in no particular order of perceived importance. We encourage you to add or delete items as you see fit.

    - The age of the clearwell, difficulties in accessing the clearwell for inspection, repair/rehabilitation and the lack of redundancy.
    - The need for various improvements/rehabilitations of the water treatment plant facilities to address capacity, water quality standards, and age and condition of the facilities.
    - The need for compliance with water quality standards for disinfection byproducts.
    - The advanced age of much of the mechanical, electrical and instrumentation equipment.
    - The need for standby power generation or alternative power feeds to booster pump stations and the Membrane Filter Plant.

- The need for greater reliability of supply into the Highland 1 District and the advisability of constructing a pump station capable of transferring water from the Highland 2 District to the Highland 1 District.

- Increasing demands being exerted on the Herron Hill Reservoir District and the reliance of the Herron Hill Reservoir District on the Highland 1 District for supply.

- Persistent pressure problems in the Bloomfield/Garfield neighborhoods in the vicinity of Penn Avenue.

- Issues related to removing distribution system storage tanks from service for periodic painting, particularly concerns related to work in the Squirrel Hill district and other districts having only a single tank.

- The need to reduce/control the amount of non-revenue water in the system.

- The need to provide sufficient fire flow capacity throughout the distribution system.

- The need to institute an increasingly aggressive water main replacement program as the pipes continue to age.

Listing and Description of Identified Water System Problems/Needs

Identify 4" Water Mains

Dead End Mains

Old Ludlow Hydt / 4" Branches

Lead Service Lines

Leadite Joints (area's)

Leak Detection Surveys

Valve Exercising / Hydt Flushing

Partyline Seperations

Inter-connection (other Water Utilities).

River Crossing Survey

Hazelwood Area (source / circulation issues)

Facilities (Pump Stations / Tanks)

River crossing inspection/evaluation including including new signage on river banks

2. Please list and provide below or on separate sheets brief descriptions of what you consider to be the most critical problems/most pressing needs facing the PWSA sewer system? Please rank by importance. As a point of reference, we identified the following major water system issues in our proposal. They are presented in no particular order of perceived importance. We encourage you to add or delete items as you see fit.

   - Compliance with the Consent Order and Agreement for the control of combined sewer overflows.
   - Addressing existing flooding problem areas
   - Replacing/repairing deteriorating sewers and manholes.
   - Incorporating green technologies for stormwater source controls

Listing and Description of Identified Sewer System Problems/Needs

Please provide your thoughts relative to the target levels of service or system performance that should be used to define acceptable system performance. The primary measures of system performance to be considered in the evaluation of the systems will include the following. We have provided values for these measures that are typically used. However, these values are subject to change and local preference and will be finalized based upon the PWSA's preferences.

- Water treatment plant capacity (permitted treatment capacity in excess of the maximum day water demand)

- Distribution system operating pressures (in excess of 20-psi at all times, normal operating pressure 35-psi minimum)

- Distribution system fire flow capacity (500-gpm to 3,000-gpm at 20-psi residual pressure depending on local fire protection requirements) As a point of reference, based upon hydrant flow testing performed on PWSA's hydrants during the past 3 years, Roughly 11% of PWSA's hydrants have a capacity of 500-gpm or less, 28% have a capacity between 500-gpm and 1,000-gpm, 18% have a capacity between 1,000-gpm and 1,500 gpm, and 43% have a capacity greater than 1,5000-gpm). The attached map illustrates the distribution of these hydrant test results.

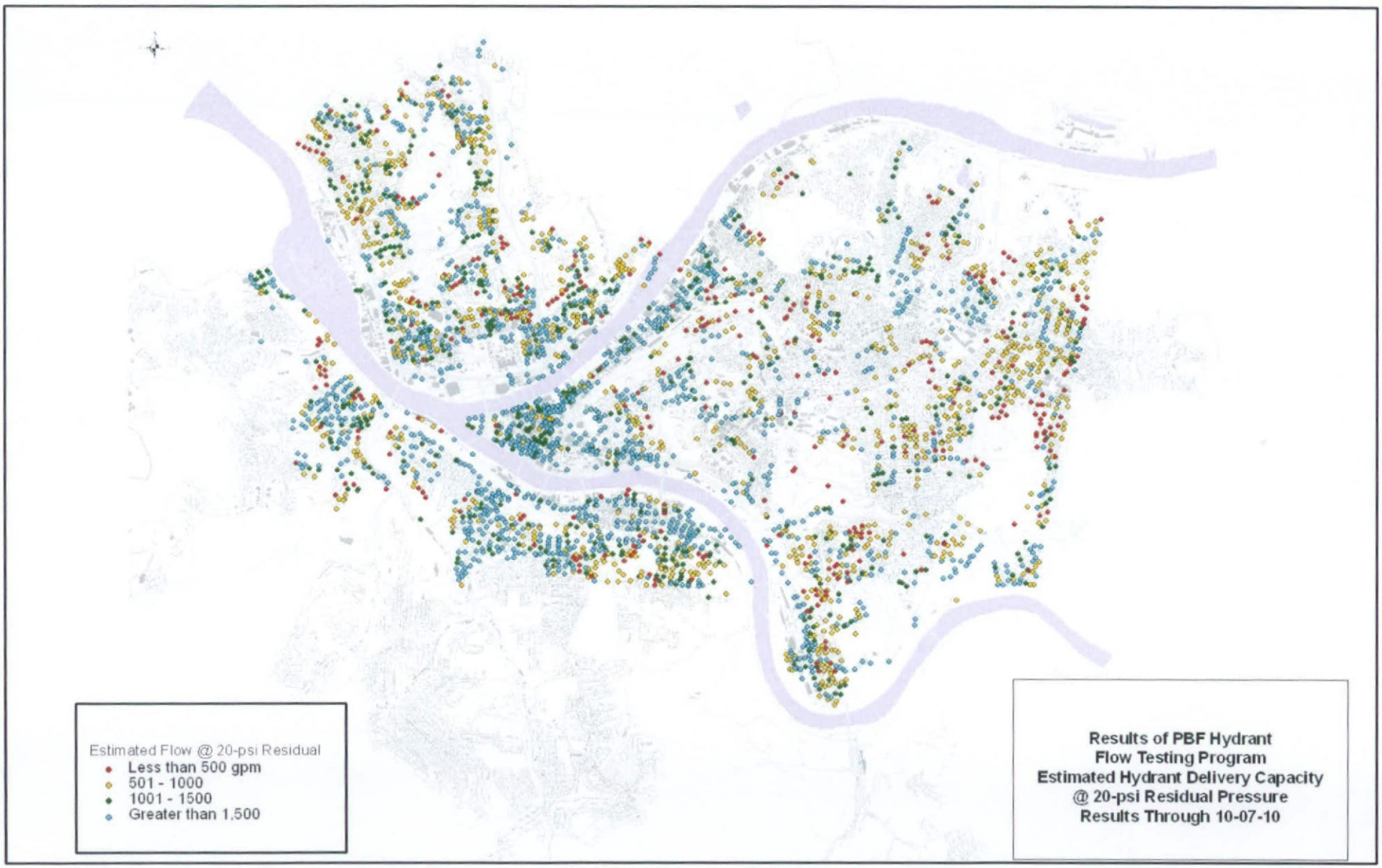
- Pump Station firm pumping capacity (greater than or equal to the maximum day demand within the area supplied)

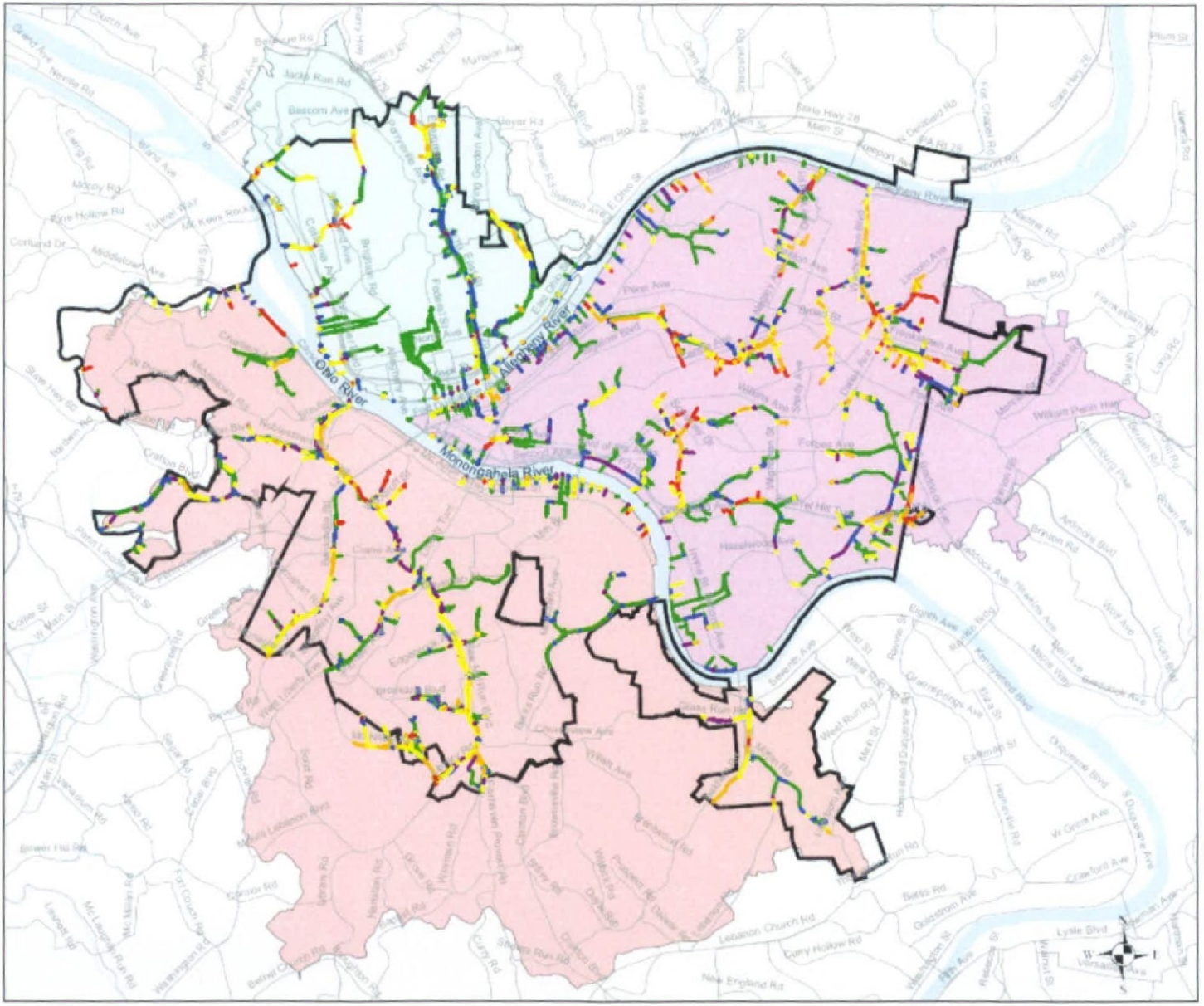
- Distribution system storage (Total storage requirement is the sum equalization volume plus the larger of a fire flow volume or an emergency storage volume. Equalization volume equals the difference between the peak hour system demand and the firm pumping capacity of the supplying station for a 6-hour period. Fire flow volume equals the targeted fire flow rate capacity for a duration of 3-hours.

Emergency storage volume equals the maximum day demand rate for a period of 4-hours)

- Sewer system conveyance capacity without flooding/basement flooding (most commonly 10-year to 25-year design storm capacity). The attached mapping that was produced as part of PWSA Hydraulic and Hydraulic Characterization Report presents computed surcharge depths in trunk sewers that were modeled for the study for 5-year, 10-year and 25-year design storm conditions. This provides an indication of the levels of service currently provided by the system.

3. Please provide any other comments below or on a separate page.


Estimated Flow @ 20-psi Residual
Less than 500 gpm
501 - 1000
1001 - 1500
Greater than 1,500
Results of PBF Hydrant
Flow Testing Program
Estimated Hydrant Delivery Capacity
@ 20-psi Residual Pressure
Results Through 10-07-10



Partnering to achieve long term benefits
PWSA CSO Team
Metcalf & Eddy Baker/Wade-Trim

Legend

Pipe Surcharge Level
- No Surcharge
- 0 - 3 ft
- 3 - 5 ft
- 5 - 10 ft
- 10 - 15 ft
- >15 ft

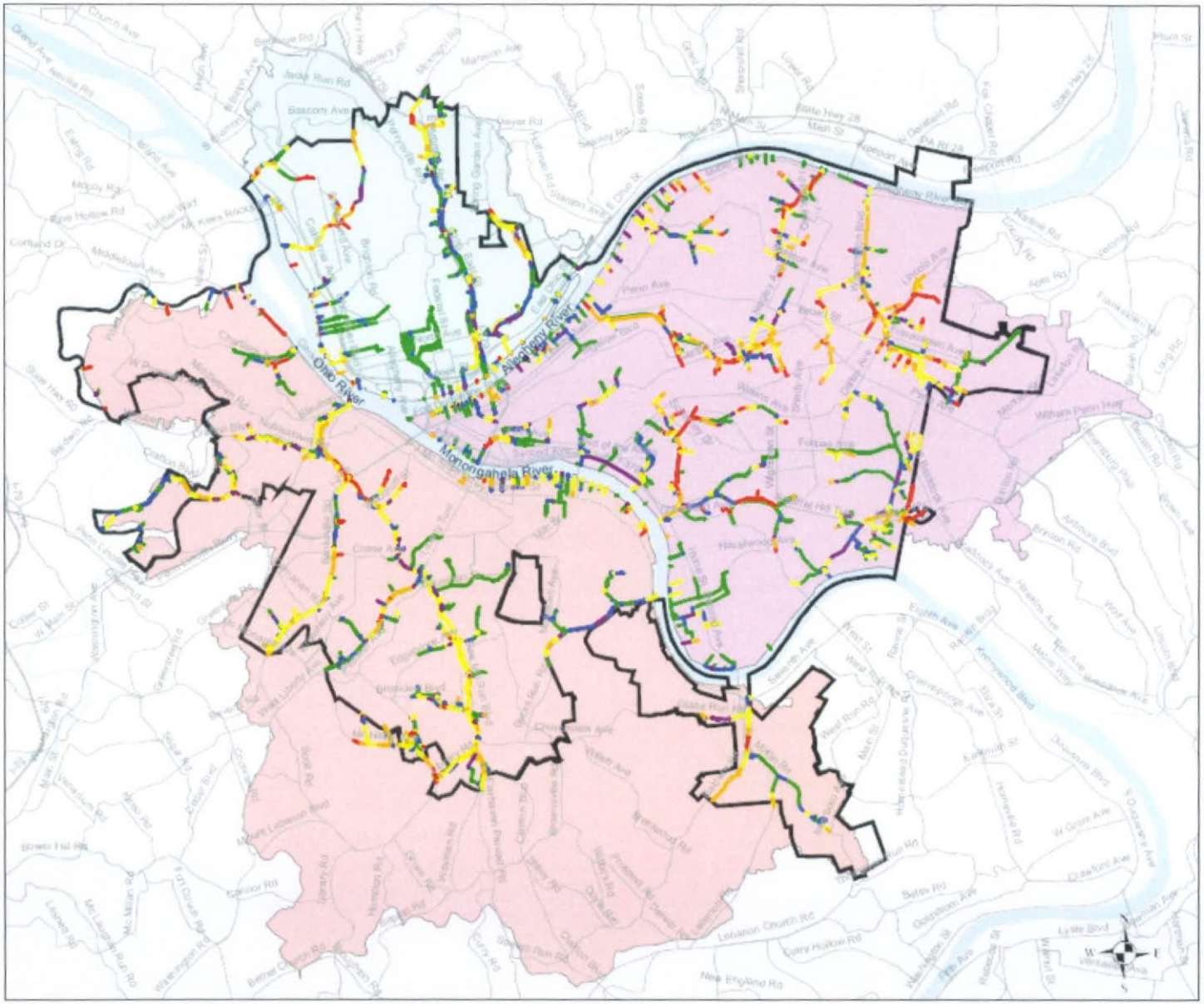
PWSA Sewersheds
- East Sewersheds
- North Sewersheds
- South Sewersheds
- City of Pittsburgh

0 1 2 Miles

Figure 8-4
All Sewersheds
5 Year-24 Hour Design Storm
Level of Service
(Base Line Conditions)

PWSA Collection System Hydraulic & Hydrologic Characterization Report

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service



Partnering to achieve long term benefits
PWSA CSO Team
Metcalf & Eddy Baker/Wade-Trim

Legend

Pipe Surcharge Level
- No Surcharge
- 0 - 3 ft
- 3 - 5 ft
- 5 - 10 ft
- 10 - 15 ft
- >15 ft

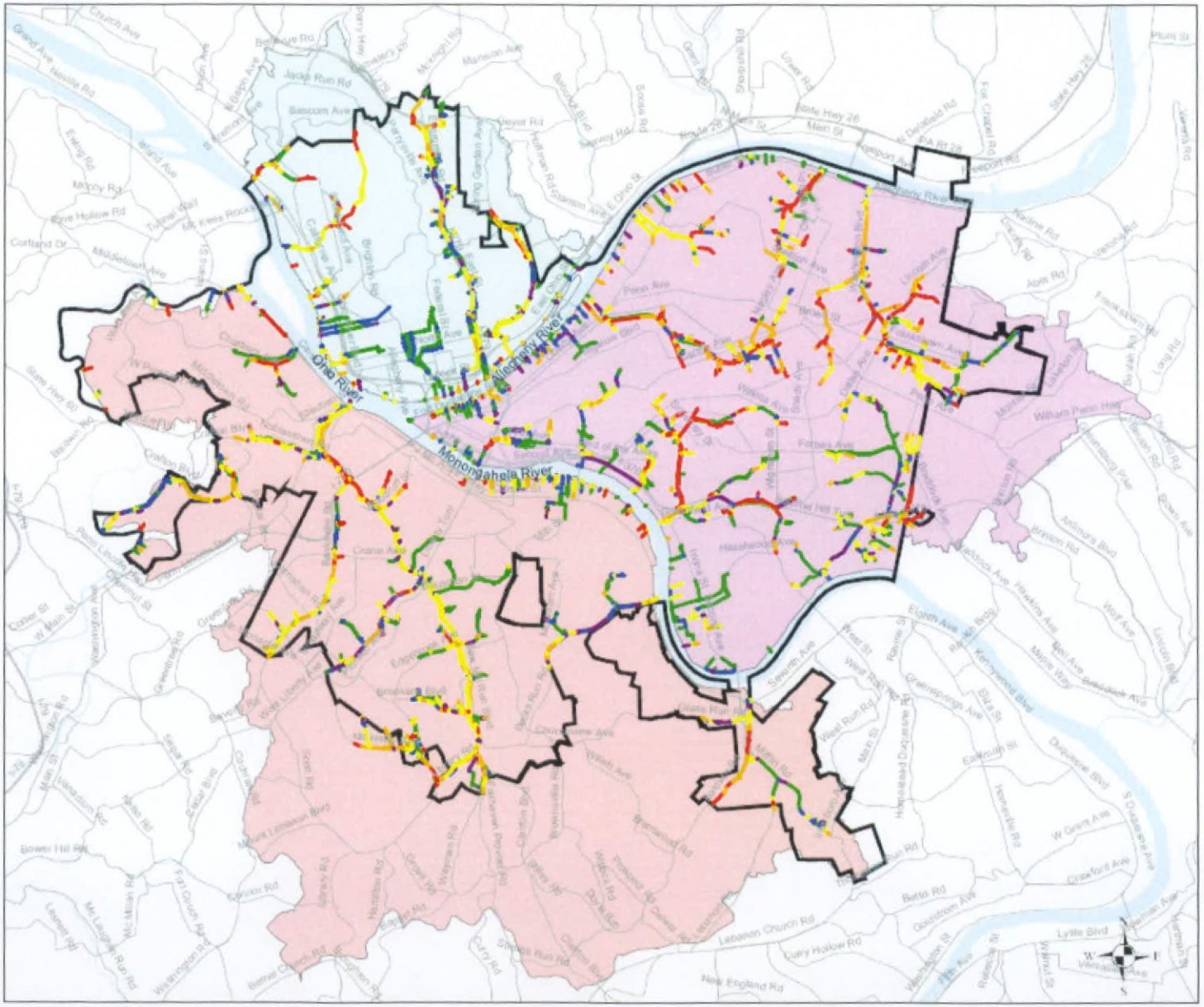
PWSA Sewersheds
- East Sewersheds
- North Sewersheds
- South Sewersheds
- City of Pittsburgh

0 1 2 Miles

Figure 8-5
All Sewersheds
10 Year-24 Hour Design Storm
Level of Service
(Base Line Conditions)

PWSA Collection System Hydraulic & Hydrologic Characterization Report

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service



Partnering to achieve long term benefits
PWSA CSO Team
Metcalf & Eddy Baker/Wade-Trim

Legend

Pipe Surcharge Level
- No Surcharge
- 0 - 3 ft
- 3 - 5 ft
- 5 - 10 ft
- 10 - 15 ft
- >15 ft

PWSA Sewersheds
- East Sewersheds
- North Sewersheds
- South Sewersheds
- City of Pittsburgh

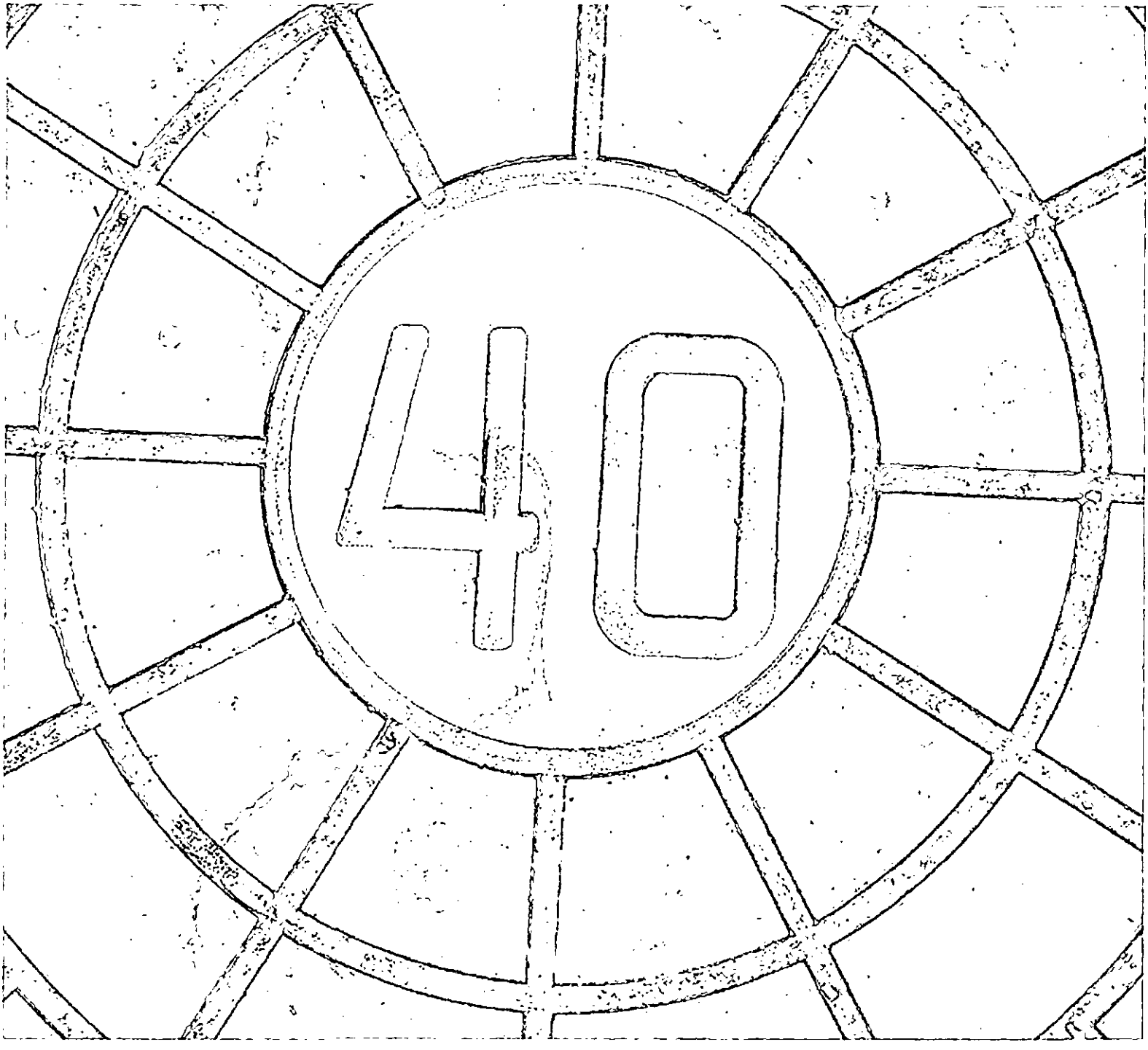
0 1 2 Miles

Figure 8-6
All Sewersheds
25 Year-24 Hour Design Storm
Level of Service
(Base Line Conditions)

PWSA Collection System Hydraulic & Hydrologic Characterization Report

PWSA
THE PITTSBURGH WATER & SEWER AUTHORITY
Quality Water Quality Service

APPENDIX 2-1



APPENDIX 2-1
INFORMATION FROM MEETINGS WITH AGENCIES

Collective Efforts, LLC
Civil and Environmental Engineers

May 20, 2011

Charles J. Jordan, P.E.
Senior Project Manager
Chester Engineers
1250 Penn Avenue
Pittsburgh, PA 15222-2219

Subject: Regulatory and Local Planning Department Meeting Summaries
Pittsburgh Water and Sewer Authority - 40-Year Capital Plan
Allegheny County, Pennsylvania
CE Project No. 10-10427

Dear Mr. Jordan:

Collective Efforts, LLC (Collective Efforts) thanks you for the opportunity to assist Chester Engineers with the local meetings/discussions in which we gathered information about the opportunities for regionalization as this relates to the Pittsburgh Water and Sewer Authority (PWSA), 40-Year Capital Plan. In summary, Collective Efforts attended four meetings, one each with the following organizations/dates:

- City of Pittsburgh, Department of City Planning – May 4, 2011
- Allegheny County Department of Economic Development – May 5, 2011
- Allegheny County Health Department – May 10, 2011
- Pennsylvania Department of Environmental Protection – May 10, 2011

For ease of incorporation of this data into you overall report, Collective Efforts has provided meeting summaries of the events that were completed for Task 2 of the Scope of Work as individual attachments to this letter. We will provide you with both a hard copy of this submittal, as well as forward the electronic Word™ documents.

At the conclusion of our meeting with the Allegheny County Health Department, Mr. David Troianos noted that it may be beneficial to meet with PWSA to review the meetings/information provided and to get PWSA feedback as to what data they want to be incorporated into the 40-Year Capital Plan. Please note that we would be happy to meet with PWSA representatives as necessary to present some or all of the findings.

We thank you again for this work and look forward to any questions that Chester Engineers may have on this submittal.

Sincerely,
Collective Efforts, LLC

Kathy Chavara, P.E.
Principal

Attachments

ATTACHMENT A
City of Pittsburgh
Department of City Planning

Department of City Planning

This meeting was held at the City of Pittsburgh, Department of City Planning located at 200 Ross Street in Pittsburgh, Pennsylvania. The meeting was held on Wednesday, May 4, 2011 at 1 PM.

Meeting attendees included:

- Mr. Dan Sentz, Environmental Planner
- Mr. Andrew Dash, AICP, Senior Planner
- Mr. Justin Miller, Senior Planner
- Mr. David Troianos, PE, Chester Engineers
- Ms. Kathy Chavara, PE, Collective Efforts, LLC

A brief *Existing Conditions and Projected Development Survey* (included in Attachment E) was forwarded to Mr. Dan Sentz just before the meeting with the City Planners. Although the survey was not returned, we did spend most of the meeting time in discussions about what the City of Pittsburgh, Department of City Planning has witnessed in relation to development trends and where they anticipate specific land uses within the City in the longer term.

The Planners talked about a neighborhood analysis web tool identified as SNAP; accessible at www.pghsnap.com . This tool is being developed to provide a free assessment of the existing conditions of a property in the City of Pittsburgh, with consideration of sixteen planning sectors. Several of the noted planning sectors include transportation, demographics, land use, and existing buildings. Andrew Dash is working on the development of a SNAP component as it relates to the use/reuse of open space and the potential connection to address stormwater management. Over the next few years, City Planners will be looking toward completion of planning sectors such as overall infrastructure assessments and a land use component as part of the overall tool. The web site supports static links to current City mapping as well.

In addition, "Action Planning" is taking place to specifically look at interventions in particular parts of the City. This work is being completed in conjunction with the Urban Redevelopment Authority of Pittsburgh (URA).

When discussing anticipated projects that may significantly modify land use or zoning, a few areas around the City of Pittsburgh were discussed, including:

- *Lower Hill District* – This area is located around the Civic Arena and will most likely see redevelopment/reuse over the next 20 years. There are just shy of 30 acres in this vicinity that have not been updated (infrastructure-wise) since the 1950s and 1960s.
- *Fifth and Forbes Avenues* – This area will most likely see moderate growth over the next 10 years. The mixed use in this location will most likely continue and will most likely include the expansion of the campus living area for Duquesne University along Forbes Avenue.
- *North Shore* – New street grids are anticipated for the areas around the existing North Shore developments. Specially Planned (SP) areas/development will most likely follow the street grid work and may include a mixture of commercial, entertainment, restaurants and retail. Development in this area is anticipated within the next 10 years.
- *Top Hill District* – This area may see lower cost residential development.
- *Lower Washington Place* – This area may see heavier densities.
- *Strip District* – Several projects were noted as current, including work that the Buncher Company is doing to renovate two existing buildings, and the Allegheny Riverfront Vision Plan. Partners for the Allegheny Riverfront Vision Plan include the Department of City Planning, the

URA, Riverlife and Perkins Eastman. Details of the Allegheny Riverfront Vision Plan that focus on areas along the southern shores of the Allegheny River from 11th Street to Washington Boulevard in Highland Park can be found on the web at http://alleghenyriverfront.pittsburghpa.gov. Anticipated redevelopment focus specified in the Allegheny Riverfront Vision Plan includes a mixture of residential, office and retail uses.

- *South Side Works* – This area has recently experienced redevelopment and additional development is anticipated along Sydney and 26th Streets. Both residential and parking are uses being considered longer term; with a new hotel, restaurants and offices anticipated in the next few years.
- *Mount Washington* – Plans for a substantial investment at the western end of Grandview Avenue is anticipated within the next 5 years.
- *Former LTV Steel Site, Hazelwood* – Almono, LP has developed a few Master Plans related to the redevelopment of this former steel facility.
- *UPMC* – UPMC is looking to eventually expand UPMC Mercy. This expansion is anticipated in a 10-year time period.

Additional, but more general trends were discussed, including anticipation for higher densities in locations around the bus way and light rail systems; for example, Homewood and East Liberty.

Open space and the redevelopment/renewal of existing recreational facilities are being addressed for some of the facilities constructed in the late 1930s and 1940s. A community and recreation center is being designed currently for Riverview Park.

The City Planners identified that there is a modest retention of population in the City of Pittsburgh. Population numbers discussed, and as presented in the Comprehensive Plan, projects population by 2035 between 330,000 and 335,000 people. However, the City Planners noted that the trend is to rent, not own property.

At the conclusion of the meeting, we briefly discussed the following areas of the City that the Planers were aware of either water service, sanitary or stormwater concerns or repetitive issues. The areas noted included the 31st Ward (numerous water main breaks), and within greenways of Perry South, Arlington, Mt. Oliver and other southern hilltop communities.

ATTACHMENT B
Allegheny County
Department of Economic Development

This meeting was held at the Allegheny County Department of Economic Development (ACDED) located at 425 Sixth Avenue, Suite 800 in Pittsburgh, Pennsylvania. The meeting was held on Thursday, May 5, 2011 at 3 PM.

Meeting attendees included:

- Ms. Kay Pierce, Manager, Planning
- Ms. Christine Goswick, Planner II
- Ms. Kathy Chavara, PE, Collective Efforts, LLC

A brief *Existing Conditions and Projected Development Survey* (included in Attachment E) was forwarded to Ms. Kay Pierce just before the meeting with the County Planners. One survey, completed by Mr. Patrick Earley, Manager, Development, is included with this Attachment. Mr. Earley noted the planned improvements were being considered for a new hotel development on 4th and Ross Streets. This development is estimated to be completed in 2013; another hotel development is also scheduled for completion in 2013 on 5th Avenue in Oakland.

The remainder of the meeting was spent in review of current activities that the ACDED is involved with, specifically related to development trends and the City. The County Planners introduced a number of activities and studies that they have been involved with that may help to provide overall guidance and insight related to future development, population, infrastructure needs, etc. These resources include:

- *Allegheny Places* – The Allegheny County Comprehensive Plan, dated December 2008, provides much information about all of Allegheny County, including the City of Pittsburgh. Chapter 4 of Plan includes a section on utilities. The Allegheny County Comprehensive Plan can be accessed via the web at http://www.alleghenyplaces.com/default.aspx . As of January 2011, a map viewer has been activated to provide a link to local GIS data. Unfortunately, the map link was not readily available.
- *Connect* – Connect's mission is to coordinate the activities of the City of Pittsburgh and the 35 municipalities that share its border through: advocating for and voicing the collective interests of the urban core and its 680,745 residents; developing and enhancing ways the 36 municipalities work together to deliver important public services; and maintaining a forum for the discussion, deliberation and implementation of new ways to maximize economic prosperity for Western Pennsylvania. Members noted include: the City of Pittsburgh, Aspinwall, Baldwin Borough, Baldwin Township, Bellevue, Brentwood, Castle Shannon, Crafton, Dormont, Edgewood, Etna, Fox Chapel, Green Tree, Homestead, Ingram, Kennedy, McKees Rocks, Millvale, Mt. Lebanon, Mount Oliver, Munhall, O'Hara, Penn Hills, Reserve, Robinson, Ross, Rosslyn Farms, Scott, Shaler, Sharpsburg, Stowe, Swissvale, West Homestead, West Mifflin, Whitehall, and Wilkinsburg. Connect is accessed via the web at http://connectpittsburgh.wordpress.com . The current municipal agreements are noted at http://connectpittsburgh.wordpress.com/municipal-agreements-2 .
- *Allegheny Together* – Allegheny Together is a program that was launched in 2007 by County Executive Dan Onorato in four pilot communities. Allegheny Together was developed to assist traditional pedestrian-based business districts throughout the County and was structured to stress community organization and data-driven planning as a way to direct public investment, spur private investment and revitalize communities. The current program communities include Bellevue, Bridgeville, Carnegie, Coraopolis, Dormont, Elizabeth, Stowe, Tarentum and Verona. Allegheny Together's Mission, "to encourage well-planned, well-designed and geographically-focused investment in the established, urban commercial districts of Allegheny County while respecting the unique history, character, and built environment of each," can be found at the web address: http://towncenter.info/downtown/allegheny_together/index.aspx .

- *ARTEZ* - In 2003, Allegheny River Towns Enterprise Zone (ARTEZ), an economic development agency was formed to collaborate with seven communities along the Allegheny River. These communities include Millvale, Etna, Shaler, Sharpsburg, O'Hara, Aspinwall, and Blawnox. The following web address, http://www/artez.org , can be used to view a database of properties for sale or lease within these communities as of July 2009.

In addition to the above provided resources, ACDED provided copies of the April 1996 *Comprehensive Water Supply Plan* and the November 1999 *Comprehensive Sanitary Sewage Management Plan*, each prepared for Allegheny County.

Based on our understanding that the PWSA 40-Year Capital Plan highlights current water service to Aspinwall, Blawnox, Fox Chapel and Reserve Township, the County Planners offered that the former Boy Scout Camp has the potential for future development in Aspinwall, while the land available in Reserve Township must deal with landslide prone soils and regulations that are under modification.

One trend that County Planning has recently witnessed is the desire of residents to walk to work.

Their population data and demographics for the County are based on PA Data Center information. This data can be accessed at the Pennsylvania Spatial Data Access (PASDA), which is the official public access geospatial information clearinghouse for Pennsylvania. PASDA provides information in both GIS and PDF formats, and links to Allegheny County GIS mapping (via the map viewer) and Google maps. Population data is noted by County only and contains data from the 2000 census. The County Planners noted that they anticipate an update soon that will supply similar data based on the 2010 census.

The Pittsburgh Water & Sewer Authority (PWSA)
40-Year Capital Plan

PWSA is in the process of preparing a 40-Year Capital Plan. The plan will include needs assessments to identify the future improvements required to maintain and enhance the performance of the existing water and sewer systems. The plan will also investigate opportunities for system expansion through regionalization or PWSA acquisitions.

The purpose of this questionnaire is to obtain input from your organization regarding current problem areas and projected future development that could impact current loading within the PWSA water and sewer systems. Your participation in the planning process is a vital component in charting the future direction of PWSA. Therefore, we ask that you fill out the following questionnaire so that your input can be utilized as a basis for future discussions to ensure that your specific concerns are captured and considered. If you have any questions or comments regarding this questionnaire, please contact Kathy Chavara of Collective Efforts at 412-459-0114 or kchavara@collectiveefforts.com .

Thank you in advance for your prompt attention to this survey!

Name of Person Completing Questionnaire	PATRICK Earley
Title	MANAGER, DEVELOPMENT
Organization Represented	ACED
Telephone Number	412-350-1061
e-mail Address	john.earley@alleghenycounty.us

1. Are there any anticipated projects that would significantly modify existing land use and/or zoning? Please list any projects along with their estimated completion dates.

No

2. Are there planned improvements for additional hotels, hospitals, college campus expansions, etc. in the near or distant future? Please list any improvements along with their estimated completion dates.

Planned Hotel development on 4th Street + Ross Street

est. Completion: 2013

Planned Hotel development on 5th Ave in Oakland

est. Completion: 2013

3. Are there any known or anticipated major roadway or city block redevelopment projects? Please list any projects along with their estimated completion dates.

N/A

4. Are there any other groups, developers, or investors that might be good to speak with about general expansion plans in the City? Please provide the group's name as well as a contact person and phone number or email address, if known.

N/A

5. Are there any industrial areas that are planned for redevelopment, e.g. Green Boulevard Project? Please list any areas along with their estimated completion dates.

N/A

6. Please comment on your experience with green infrastructure and any desire to incorporate it to a greater extent within City-owned properties.

N/A

7. Are there any areas within the City known to have inadequate water, sanitary, or storm sewer services? Please be specific as to location and service issue, i.e., Sanitary – 500 block Jones Street – manhole surcharging whenever it rains.

N/A

8. Are there any areas within the City known to have concerns with water pressure or fire flow? Please be specific.

N/A

9. Are there any areas within the City known to experience numerous or repetitive water main breaks? Please be specific.

N/A

10. Please provide information regarding the population changes your organization is projecting within the City and surrounding region over the next five, 15, and 40 years.

N/A

ATTACHMENT C
Allegheny County Health Department

This meeting was held at the Allegheny County Health Department (ACHD) offices located at 3901 Penn Avenue in Pittsburgh, Pennsylvania. The meeting was held on Tuesday, May 10, 2011 at 9 AM.

Meeting attendees included:
Ms. Michelle Buys, ACHD Project Engineer
Ms. Lisa Sorg, ACHD
Mr. John Jeffries, ACHD Supervisor Public Drinking Water and Waste Management Program
Ms. Barbara Grosch, ACHD Environmental Health Specialist II
Mr. Michael Moskorisin, ACHD Environmental Health Administrator
Dr. Stanley States, PWSA Director of Water Quality and Production
Mr. David Troianos, PE, Chester Engineers
Ms. Kathy Chavara, PE, Collective Efforts, LLC

A brief *Existing Conditions and Projected Development Survey* (included in Attachment E) was forwarded to Ms. Michelle Buys prior to the meeting with the ACHD. Although completed surveys were not returned, we spent the majority of the meeting in discussions about what conditions the ACHD sees both in the field as well as based on complaints received. Mr. Jeffries noted that there were very few common complaints related to the water supply. He noted that the Millvale experiences a low water pressure; Dr States indicated that PWSA has been working with Millvale on this issue. Mr. Jeffries noted that there are no chronic "dirty" water calls; and if the ACHD does receive a call of this nature, it generally has been caused by recent construction activities. At this point in the meeting, Ms. Buys provided a two page spreadsheet containing a summary of the complaints recorded by the ACHD. A copy of this document is included within Attachment E of this document.

Overall, the ACHD staff attending the meeting commended PWSA on the quality of water provided by PWSA. The age of the existing infrastructure is of concern to the ACHD; as was the potential to replace existing water line infrastructure at many of the existing brownsfield sites in Pittsburgh.

We briefly discussed the current/formal Fire Flow Testing that PWSA performs and the Fluoride Tracer Study that PWSA prepared. ACHD was happy with each and asked that PWSA maintains current testing and tracer studies.

Dr. States noted that PWSA is managing a current water plant capital improvement project and that PWSA continues to inspect/repair/replace the larger (12" and greater) valves within the PWSA system. Valve locations and conditions are maintained by PWSA within their GIS mapping coverage of the system. The ACHD stressed the importance of 100% compliance related to turning the valves every 3 years (or at maximum, every 4 years for a system the size of Pittsburgh).

It was noted that PWSA continues to maintain their lines, isolate breaks when necessary, and maintain valves, lines and the appurtenances when paved-over. Dr. States noted that PWSA categorizes the age of their system in the approach that PWSA will look to replace those lines installed in the 1940's and 1950s, when material was scarce. Water lines installed during this time period tend to have more failures; however, there are a tremendous number of miles of water lines in this category and current budgets that allow for the replacement of minimal mile(s) per year.

While addressing the future, the ACHD requested that PWSA optimize the flushing program. Ms. Grosch voiced that ACHD looks for system modeling to indicate areas where PWSA should flush prior to "reactive flushing" that may occur following a water main break.

Current regulations include sampling/evaluation of trihalomethanes (THM) and source water protection monitoring within the rivers (intake) for bromide. Currently, there are no Unregulated Contaminant Monitoring Regulation (UCMR) hits yet. Chromium has been detected in low levels; however, this constituent is a natural contaminant. Following a brief discussion related to the studies being conducted in 25 cities across the United States, the group agreed that future sampling and possibly treatment may be considered to address trace pharmaceuticals, i.e.; estrogen. PWSA and the ACHD look for this directive under the UCMR3 expected in the next three years (2014). Recently, radioactive Iodine 131 was found in the drinking water supplies in Philadelphia, Pennsylvania. The ACHD conducts weekly sampling at the open water reservoirs; all three sampling locations show no indications of radioactive iodine.

At this point in the discussion, Ms. Buys provided a copy of the *Semi-Annual Progress Report (Reference COA, Appendix E)* for the reporting period of July 1, 2010 to December 31, 2010. This document is included for reference within Attachment E of this document and was noted as a document that must be provided to the ACHD every 6 months. A brief discussion followed and highlighted consideration of concerns about the disinfection of combined sewer overflows (CSOs) potentially causing other concerns for water treatment/intake locations. The comments specifically addressed concerns that as more chemicals are added to sanitary treatment processes, these same chemicals have the potential to enter source waters; (i.e.; dechlorination).

The ACHD noted that they do understand that stormwater plays a role in meeting the CSO objectives for our area, and that bacteria loadings (from the stormwater) cause public health and recreation issues. Ms. Buys provided a *PWSA CSO Volume* record (see Attachment E) for 2006 that shows that PWSA is not meeting the 1994 CSO Policy, nor Water Quality Standards. She indicated that the Pennsylvania Department of Environmental Protection (PADEP) will be looking at the 21 dry weather overflows noted in 2008.

Ms. Buys also noted that the ACHD would like to see aging/failing pump stations rebuilt. Service requests between 2004 and 2011 could be improved.

Mr. Moskorisin identified that the ACHD had calls from the following locations with respect to on-lot sanitary systems in the City of Pittsburgh: 31st Ward (expects that the waste is disposed directly into the mines), 28th Ward, 26th Ward (Mount Pleasant), and the 27th Ward (Jack's Run and Ross Township boarder). He estimated that approximately 500 homes in the City of Pittsburgh are private septic. An *On-lot* handout was provided, see Attachment E.

In closing, there was a brief discussion that Federal emphasis may be headed to area supporting 10,000 to 20,000 populations; and that PADEP is looking toward distribution optimization.

ATTACHMENT D
Pennsylvania
Department of Environmental Protection

The final of four local meetings was held at the Pennsylvania Department of Environmental Protection offices located at 3901 Penn Avenue in Pittsburgh, Pennsylvania. The meeting was held on Tuesday, May 10, 2011 at 10:30 AM.

Meeting attendees included:
Mr. Ronald Schwartz, PE, BCEE, Assistant Regional Director
Mr. Sam Harper, PE, Water Quality Management Program
Dr. Stanley States, PWSA Director of Water Quality and Production
Mr. David Troianos, PE, Chester Engineers
Ms. Kathy Chavara, PE, Collective Efforts, LLC

Similar to the previous meetings, a brief *Existing Conditions and Projected Development Survey* (included in Attachment E) was forwarded to Mr. Ronald Schwartz prior to the meeting. The survey was used as an outline of meeting topics and focus; however, no surveys were returned.

Mr. Schwartz noted that the policies are written and directed out of Harrisburg, even those related to the current Marcellus shale industry. The approach for this particular industry, related to drinking water intake as well as discharges will be to control bromide and to control total dissolved solids (TDS). The DEP representatives noted that the power, steel and shale industries are looking at treatments that consider zero liquid discharge. DEP noted that the larger issues include: CSO containment, MS4 issues, and bacteriological issues.

Larger developments that DEP is familiar with include the expansion of the Allegheny Coke Works (which has not moved forward lately) and Allegheny Ludlum Brackenridge project. On the sanitary side of things, DEP is focused on ALCOSAN and PWSA commitments within the Consent Orders.

Within the Allegheny Watershed area, DEP foresee the use of scrubbers to clean the smoke stacks more efficiently, folks will be burning PA coal, and there will be a focus on the previously mined areas.

Historically, Mr. Schwartz and Mr. Harper noted that the redevelopment of the numerous brownsfield sites was very strong in the 1990s, following the enactment of Act 2 which risked away site liabilities.

The National Pollutant Discharge Elimination System (NPDES) program will continue to strengthen; with focus on suspended solids, infrastructure, urban runoff, etc. DEP envisions that this will be phased in as over the next 5 years. Enactment of NPDES sampling for discharges may be sometime yet. Future regulations will likely address pharmaceuticals and will necessitate the discussion of treatment (i.e.; water pretreatment or sanitary treatment prior to discharge).

They noted that Carnegie Mellon University is looking at many water-focused topics, including H2O Opportunities which looks at marketing the Pittsburgh water wealth to high-volume water industries. DEP also believes that the public will demand higher water quality. From a geographically low hanging fruit perspective, the communities which are located for regionalization opportunities surrounding Pittsburgh include: Reserve, Aspinwall, Fox Chapel, Blawnox and Millvale.

In closing, Mr. Schwartz noted that we may want to investigate the compliance and/or new projects as recorded within the state's eFacts system. In the longer term, the state's eNotice can be accessed and the public can use this system to receive e-mails about violations, trends for particular industries, general environmental data.

ATTACHMENT E
Items Provided by Meeting Hosts

Log No.	E-Facts No.	Complainant	Complainant's Address	Complainant's Phone No.	Complaint Location: Street No	Complaint Location: Street	Complaint Location: City,	Complaint	Type of Problem	Date Received	Assign To	
04-010		Bob Maffeo	4740 Longcan Avenue, 31st Ward	412-482-3239		rear garage drains to Kirley Way sewer	Pittsburgh, PA	Pittsburgh	sewage backup, sewage in street	01/07/04	MM	01/07/04
04-015		Ida Dastrul?	163 Kilmer Street, Pittsburgh		163	Kilmer Street	Pittsburgh	Pittsburgh	sewage overflow in street	01/21/04	EBW	
04-016		Tina Arginopoulos?	539 Southcrest Drive, Brookline		539	Southcrest Drive	Pittsburgh	Pittsburgh	backups, blocked lateral	01/21/04	EBW	
04-017		Leo Robbins	5400 Keefe Street (CC)		5404	Keefe Street	Pittsburgh	Pittsburgh	sewage backup, surcharge MH	01/24/04	MM	
04-018		Anonymous				Banksville Road		Pittsburgh	surcharging manhole at Eat N Park	01/23/04	PB	
04-022		Fred Henzel	1527 Amanda, Carrick	412-882-7455	1529	Brownsville Road	Pittsburgh, PA	Pittsburgh	dumping oil in catch basins, commercial property owned by Jan Hall	02/06/04	ED	02/06/04
04-041		Greg Tolbert (HCE)		412-350-4046	1121	Amanda Street	Pittsburgh	Pittsburgh	4 homes on common lateral, sewage on street	02/24/04	RP	
04-043		Fred Henzel	1527 Amanda, Carrick	412-882-7455	1529	Brownsville Road		Pittsburgh	DUPLICATE		ED	
04-046		Ann Keslin	720 Parkwood Road, Pittsburgh		720	Parkwood Road	Pittsburgh, PA	Pittsburgh	raw sewage	03/01/04	PB	
04-048		Dave Namey (HCE)		412-350-4046	190-192	Kearns Avenue	Pittsburgh, PA	Pittsburgh	house not connected to city sewer		MM	
04-052		Karen Bishop	2808 Louisiana, Pittsburgh			city steps from Wanzel	Pittsburgh, PA	Pittsburgh	sewage running down city steps	03/18/04	MM	03/18/04
04-055	1328265	ACHD			DC 018A001	Banksville Road		Pittsburgh	DWOs, inaccessable, bad construction	02/16/04	MM	02/16/04
04-060	1344335	Judith Little	Castlegate Avenue, Pittsburgh			Castlegate and Norwich		Pittsburgh	collapsed sewer and cracked sewer	03/29/04	MM	03/29/04
04-061	1328265	ACHD			DC 002K002	W. Liberty Avenue		Pittsburgh	DWO rings	03/11/04	MM	03/11/04
04-062	1328265	ACHD			DC 036M001	Poplar and Kearns		Pittsburgh	DWO rocks and bricks	03/11/04	MM	03/11/04
04-065		Helen Blackwell	1362 Point View Street, Pittsburgh	412-363-0522		Point View Street		Pitsburgh	unknown water flowing in street, rats	04/23/04	EBW	05/12/04
04-069		William Schwartz		412-281-4777		Bock's Run Road	Pittsburgh	Pittsburgh	sewage by Wayne Road and odors in stream	04/30/04	EBW	
04-083		Gail Lucas (via Plumbing)	416 Laughlin Avenue, Pittsburgh	412-884-3251	417, 418, 420	Laughlin Ave. Extension		Pittsburgh	sewage discharges	04/26/04	PB	05/09/04
04-101		Charles Taylor		412-441-8691		Wilkes and Highland	Pittsburgh	Pittsburgh	sewage discharge	05/13/04	EBW	
04-102		Fred Capuccio (ACHD)		412-578-8391		Rosetta and N. Atlantic	Pittsburgh	Pittsburgh	Unknown water	05/17/04	MM	05/17/04
04-106		Denise Jackson	707 Norwich Avenue, Pittsburgh	412-561-8452	707	Norwich Avenue	Pittsburgh	Pittsburgh	water in basement, wants us to test it	05/21/04	MM	05/21/04
04-107		Roberta Kostyak	1551 Methyl Street, Pittsburgh		1551	Methyl Street Rear yard	Pittsburgh	Pittsburgh	back yard saturated with water	05/21/04	PB	05/21/04
04-108		Marge Healy for sister			1533	Rutherford	Pittsburgh	Pittsburgh	broken sewer on Methyl, poured onto her property	05/21/04	PB	05/21/04
04-109		Vicky Barty, Larry York, Marlene Branson, Rachael Piccolino	308, 406, 412, 414 Kathleen Street	Rachael 412-381-7311	308, 406, 412, 414	Kathleen Street	Pittsburgh	Pittsburgh	chronic basment backups	05/21/04	PB	05/24/04
04-110		Ed Raskowski	1321 Kinmount Street, Pittsburgh	412-922-1764	1321	Kinmount Street	Pittsburgh	Pittsburgh	sewage backups		PB	
04-112		Jane Conner	1331 Kinmount Street, Pittsburgh	412-563-6261	1331	Kinmount Street	Pittsburgh PA 15205	Pittsburgh	sewage backup	05/21/04	PB	05/21/04
04-120	1343712	Carmen Pinan (landlord)		412-292-8991	226-228	Maple Terrace	Pittsburgh	Pittsburgh	sewage backups	05/24/04	MM	05/24/04
04-121	1343712	Al Giametta	209 West Sycamore Street	412-481-2128	209	W. Sycamore Street, South Hills Tracking and Cleaning	Pittsburgh	Pittsburgh	backups after heavy rains	05/24/04	MM	05/24/04
04-123	1343712	Robert Scarzafave	128 Maple Terrace, Pgh	412-760-1685	128	Maple Terrace	Pittsburgh	Pittsburgh	backups after heavy rains	05/21/04	MM	05/21/04
04-142		Tony Amodeo	2411 Bazore Street, Pittsburgh	412-377-6672	2411	Bazore Street	Pittsburgh	Pittsburgh	main sewer backed up	05/26/04		
04-1448		Tommy Hess	4412 Woolslayer Way, Pittsburgh		4412	Woolslayer Way	Pittsburgh, PA	Pittsburgh	sewer odors in bsmt from hospital construction?	03/27/04		

OSBA-I-4 Attach A

04-147		Homer Ramsey	2310 W. Liberty Avenue, Pittsburgh	412-343-1200		West Liberty Chrysler	hillside behind car sales lot	Pittsburgh	waterfall, drainage	05/28/04	MM	05/28/04
04-159		Bill Hamilton (Food)	ACHD	412-578-8044		Noblestown and Obay Sts	Pittsburgh	Pittsburgh	sewage discharge	06/08/04	NR	
04-160		Marilyn Zrust		412-922-8884		Kearns Avenue	Pittsburgh	28th Ward	stream is white	06/11/04	MM	06/15/04
04-161		Leanne Onorato via Mike Como and Dr. Dixon			3004, 3005, 3012	Perrysville Avenue	Pittsburgh	Pittsburgh	buried manholes	06/08/04	PB	
04-162		John Jeffries	ACHD	412-578-8040		East Myers and Amanda	Pittsburgh	Pittsburgh	dumping oil in catch basins	04/08/04	ED	
04-192		Roberta Kosryak	1551 Methyl Street, Pittsburgh	412-341-9259	1551	Methyl Street Rear yard	Pittsburgh, PA	Pittsburgh	drainage, wants us to test	06/28/04	PB	
04-197		Davis Gazdik		412-802-7812		Allegheny River between 40th & 42nd Streets		Pittsburgh	brown foam	07/02/04	PMB	
04-202		Mike Fleishammer	6419 Bartlett Street, Pittsburgh, PA 15217	412-422-1341	6419	Bartlett Street	Pittsburgh, PA	Pittsburgh	lateral crushed by PWSA, sewage backing up in basement	07/07/04	EBW	07/07/04

SEMI-ANNUAL PROGRESS REPORT

(Ref: CQA, Appendix E)

Authority: Pittsburgh Water and Sewer Authority
Watershed: CSO Municipalities
Revision Date:
Reporting Period From: July 1, 2010 To: December 31, 2010

Task Description	Proposed Start Date	Actual Start Date	Required Completion Date	Actual Completion Date	Required % of Project Completed	Actual % of Project Completed	Comments
PHASE I: System Inventory / O & M							
(A) Physical survey (Year 1) Critical/SSS	Jun 1, 2004	Jun 1, 2004	May 31, 2005	Dec 31, 2004	33%	34%	3301 MHs inspected to date, 10% of total, 1560 Critical/ SSS MHs inspected out of 4581, 34% of Cri/SSS
Physical survey (Year 2) Critical/SSS	Jun 1, 2005	Jun 1, 2005	May 31, 2006	Mar 31, 2009	66%	67%	4,788 inspected out of 7,180 total Critical/SSS manholes based on current GIS mapping. 1,544 (22% of total) of those not inspected were inaccessible or not located.
Physical survey (Year 3) Critical/SSS	Jun 1, 2006	Apr 1, 2009	May 31, 2007		100%	99.4%	Out of 7,035 total Critical/SSS manholes based on current GIS mapping, 5,136 (73.0% of total) were inspected & 1,856 (26.4% of total) of those not inspected were inaccessible, buried, or not located.
Physical survey (Year 4) Non-Critical	Jun 1, 2007	Jan 1, 2008	May 31, 2008	May 31, 2008		55%	10,062 inspected out of 18,161 total Non-Critical manholes based on current GIS mapping. 2,832 (18% of total) of those not inspected were inaccessible or not located.
Physical survey (Year 5) Non-Critical	Jun 1, 2008	Jun 1, 2008	May 31, 2009	May 31, 2009		69%	12,813 inspected out of 18,414 total Non-Critical manholes based on current GIS mapping. 3,831 (21% of total) of those not inspected were inaccessible or not located.
Physical survey (Year 6) Non-Critical	Jun 1, 2009	Jun 1, 2009	May 31, 2010	May 31, 2010		92%	Out of 18,370 total Non-Critical manholes based on current GIS mapping, 12,639 (69% of total) were inspected & 4,259 (23% of total) of those not inspected were inaccessible, buried, or not located.
Physical survey (Year 7) Non-Critical	Jun 1, 2010	Jun 1, 2010	May 31, 2011			98.1%	Out of 18,345 total Non-Critical manholes based on current GIS mapping, 13,200 (72.0% of total) were inspected & 4,799 (26.2% of total) of those not inspected were inaccessible, buried, or not located.
Physical survey (Year 8) Non-Critical	Jun 1, 2011		May 31, 2012				
Physical survey (Year 9) Non-Critical	Jun 1, 2012		May 31, 2013				
Physical survey (Year 10) Non-Critical	Jun 1, 2013		May 31, 2014				
(B) Cleaning/CCTV (Year 1) Critical/SSS	Jun 1, 2004	Jun 1, 2004	May 31, 2005	Dec 31, 2004	16.7%	47%	417,299 feet televised (including credit for past work) out of 887,870 estimated total feet of Critical/SSS sewers.
Cleaning/CCTV (Year 2) Critical/SSS	Jun 1, 2005	Jan 1, 2005	May 31, 2006	Dec 31, 2005	33.3%	45%	561,798 feet televised out of 1,220,950 estimated total feet of Critical/SSS sewers.
Cleaning/CCTV (Year 3) Critical/SSS	Jun 1, 2006	Jan 1, 2006	May 31, 2007	May 31, 2007	50%	51%	864,337 feet televised out of 1,680,913 total feet of Critical/SSS sewers based on current GIS mapping.
Cleaning/CCTV (Year 4) Critical/SSS	Jun 1, 2007	Jun 1, 2007	May 31, 2008	May 7, 2008	66.7%	66.7%	1,114,000 feet televised out of 1,670,510 total feet of Critical/SSS sewers based on current GIS mapping.
Cleaning/CCTV (Year 5) Critical/SSS	Jun 1, 2008	May 8, 2008	May 31, 2009	Jul 7, 2009	83.3%	83.3%	1,355,250 feet televised out of 1,626,955 total feet of Critical/SSS sewers based on current GIS mapping.
Cleaning/CCTV (Year 6) Critical/SSS	Jun 1, 2009	Jul 8, 2009	May 31, 2010		100%	99.97%	1,544,269 feet televised out of 1,580,265 total feet (97.7%) of Critical/SSS sewers based on current GIS mapping. 35,568 feet (2.3%) was attempted, but sewer was inaccessible.
Cleaning/CCTV (Year 1) Non-Critical	Jun 1, 2004	Jun 1, 2004	May 31, 2005	May 31, 2005		0%	
Cleaning/CCTV (Year 2) Non-Critical	Jun 1, 2005	Jun 1, 2005	May 31, 2006	May 31, 2006		7%	383,396 ft of non-critical sewers out of 5,605,270 ft total non-critical sewers have been televised
Cleaning/CCTV (Year 3) Non-Critical	Jun 1, 2006	Jun 1, 2006	May 31, 2007	May 31, 2007		5%	228,199 feet televised out of 4,246,074 total feet of Non-Critical sewers based on current GIS mapping.
Cleaning/CCTV (Year 4) Non-Critical	Jun 1, 2007	Jun 1, 2007	May 31, 2008	May 31, 2008		6.6%	279,257 feet televised out of 4,253,740 total feet of Non-Critical sewers based on current GIS mapping.
Cleaning/CCTV (Year 5) Non-Critical	Jun 1, 2008	Jun 1, 2008	May 31, 2009	May 31, 2009		7.9%	336,294 feet televised out of 4,255,859 total feet of Non-Critical sewers based on current GIS mapping.
Cleaning/CCTV (Year 6) Non-Critical	Jun 1, 2009	Jun 1, 2009	May 31, 2010	May 31, 2010		9.1%	385,336 feet televised out of 4,235,080 total feet of Non-Critical sewers based on current GIS mapping.
Cleaning/CCTV (Year 7) Non-Critical	Jun 1, 2010	Jun 1, 2010	May 31, 2011			18.4%	763,823 feet televised out of 4,212,389 total feet of Non-Critical sewers based on current GIS mapping. 11,013 feet (0.3%) was attempted, but sewer was inaccessible.
Cleaning/CCTV (Year 8) Non-Critical	Jun 1, 2011		May 31, 2012				
(C) GIS Mapping (Year 1)	Jun 1, 2004	Jun 1, 2004	May 31, 2005	Jun 30, 2005	33%	33%	Entire collection system now established on protocol-compliant GIS platform. Pipe and MH properties need to be assessed. GPS data integrated as field programs develop this information.
GIS Mapping (Year 2)	Jun 1, 2005	Jul 1, 2005	May 31, 2006	May 31, 2006	66%	66%	3RWW info is yet to be added to this total
GIS Mapping (Year 3)	Jun 1, 2006	Jun 1, 2006	May 31, 2007	Dec 31, 2005	100%	100%	GPS surveys from 3RWW linked to sewer system mapping. Manhole location adjustments made when necessary.
(D) Dye Testing (Year 1)	Jun 1, 2004	Jun 1, 2004	May 31, 2005	Oct 30, 2007	33%	33%	Approximately 170 buildings/residences were tested out of about 16,740 total within a 100-foot buffer from a sanitary sewer. Operations to expedite dye testing of storm and private inlets within 100-foot buffer began the summer of 2007.
Dye Testing (Year 2)	Jun 1, 2005	Oct 31, 2007	May 31, 2006	Mar 4, 2008	66%	66%	40,600 private drains & public storm inlets analyzed out of 61,526.
Dye Testing (Year 3)	Jun 1, 2006	Mar 5, 2008	May 31, 2007		100%	98.4%	Out of about 61,505 private drains, 56,322 were analyzed by PWSA and about 4,724 were analyzed by private firms for property-sales. Out of 2,741 public storm inlets, 2,146 were analyzed by PWSA. Total drains & inlets analyzed is estimated to be 63,192 out of 64,246.
(E) Enforcement - illegal connections	Jun 1, 2004	Jun 1, 2004	Nov 30, 2007		95%		Continual enforcement of point-of-sale requirements. 1,514 parcels were privately analyzed by separate sanitary sewer area property owners and were granted certifications by PWSA approving the sales if they passed their dye test results. About 4,724 drains were analyzed by private property owners due to the City of Pittsburgh property-sales ordinance requirements. Utility Line Security service corrected over 140 customer parcels with external downspouts and storm drains connected to separated sanitary sewers.

SEMI-ANNUAL PROGRESS REPORT

(Ref: COA, Appendix E)

Authority: Pittsburgh Water and Sewer Authority
Watershed:
Revision Date:
CSO Municipalities
Reporting Period From: July 1, 2010 To: December 31, 2010

Task Description	Proposed Start Date	Actual Start Date	Required Completion Date	Actual Completion Date	Required % of Project Completed	Actual % of Project Completed	Comments
(F) Ordinance Development							
(i) Prohibit Storm Water	Jun 1, 2004	Jun 1, 2004	Nov 1, 2004	Apr 12, 2006	100%	100%	Pittsburgh City Council passed ordinance on 3/28/06, approved by Mayor on 4/5/06. Effective date 7/5/06.
(ii) Point of Sale Ordinance	Jun 1, 2004	Jun 1, 2004	Nov 1, 2004	Apr 12, 2006	100%	100%	Pittsburgh City Council passed ordinance on 3/28/06, approved by Mayor on 4/5/06. Effective date 7/5/06.
(G) Deficiency corrections (Year 1) Critical/SSS	Jun 1, 2005	Jun 1, 2004	Nov 30, 2006	Nov 30, 2006	20%	20% +	Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 2) Critical/SSS	Dec 1, 2006	Dec 1, 2005	Nov 30, 2007	Nov 30, 2007	40%	40% +	Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 3) Critical/SSS	Dec 1, 2007	Dec 1, 2007	Nov 30, 2008	Nov 30, 2008	60%	60% +	Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 4) Critical/SSS	Dec 1, 2008	Dec 1, 2008	Nov 30, 2009	Nov 19, 2010	80%	80%	Responding to significant structural defects, emphasizing the correction of structural failures and those areas determined by project engineers to be imminent structural failures through point repair and line replacement as they are discovered by CCTV inspection. Other less serious problems are rectified by lining, guniting, point repair, as well as line replacement. 184 out of 231 severe deficiencies have been corrected.
Deficiency corrections (Year 5) Critical/SSS	Dec 1, 2009	Nov 20, 2010	Nov 30, 2010		100%	88%	Responding to significant structural defects, emphasizing the correction of structural failures and those areas determined by project engineers to be imminent structural failures through point repair and line replacement as they are discovered by CCTV inspection. Other less serious problems are rectified by lining, guniting, point repair, as well as line replacement. As of November 24 2010, 196 out of 222 severe deficiencies have been corrected.
Deficiency corrections (Year 1) Non-Critical	Dec 1, 2005	Dec 1, 2005	Nov 30, 2006	Nov 30, 2006			Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 2) Non-Critical	Dec 1, 2006	Dec 1, 2006	Nov 30, 2007	Nov 30, 2007			Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 3) Non-Critical	Dec 1, 2007	Dec 1, 2007	Nov 30, 2008	Nov 30, 2008			Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 4) Non-Critical	Dec 1, 2008	Dec 1, 2008	Nov 30, 2009	Nov 30, 2009			Lined, gunited and point repaired or replaced several sewers – the most severe defects were addressed first.
Deficiency corrections (Year 5) Non-Critical	Dec 1, 2009	Dec 1, 2009	Nov 30, 2010	Nov 30, 2010			Responding to significant structural defects, emphasizing the correction of structural failures and those areas determined by project engineers to be imminent structural failures through point repair and line replacement as they are discovered by CCTV inspection. Other less serious problems are rectified by lining, guniting, point repair, as well as line replacement.
Deficiency corrections (Year 6) Non-Critical	Dec 1, 2010	Dec 1, 2010	Nov 30, 2011				Responding to significant structural defects, emphasizing the correction of structural failures and those areas determined by project engineers to be imminent structural failures through point repair and line replacement as they are discovered by CCTV inspection. Other less serious problems are rectified by lining, guniting, point repair, as well as line replacement.
Deficiency corrections (Year 7) Non-Critical	Dec 1, 2011		May 31, 2012				
(H) Complete system hydraulic characterization (Year 1)	Jun 1, 2004	Jun 1, 2004	May 31, 2005	Dec 31, 2004	25%	25%	Hydraulic models under construction.
Complete system hydraulic characterization (Year 2)	Jun 1, 2005	Jan 1, 2005	May 31, 2006	Dec 31, 2005	50%	50%	Hydraulic model construction is continuing. Dry weather calibration complete, wet weather calibration started.
Complete system hydraulic characterization (Year 3)	Jun 1, 2006	Jan 1, 2006	May 31, 2007	Dec 31, 2006	75%	75%	Hydraulic model construction is continuing. Dry weather calibration complete, wet weather calibration near complete.
Complete system hydraulic characterization (Year 4)	Jun 1, 2007	Jan 1, 2007	May 31, 2008	Jun 30, 2007	100%	100%	Hydraulic model completed, incorporating both dry and wet weather calibration.
(I) Submit report of implementation of nine minimum controls		Jun 1, 2004	Dec 1, 2005	Nov 30, 2005		100%	
Submit supplemental report of implementation of nine minimum controls		Jul 1, 2010	Dec 1, 2010				
PHASE II: Planning							
Flow Monitoring	Jun 1, 2007	January 2004	May 31, 2008	May 31, 2008		100%	PWSA Monitoring Plan submitted January 2004, Flow Monitoring Report submitted February 2007, & Flow Monitoring Extension Report submitted July 2007. PWSA participated in the Regional Flow Monitoring group led by 3RWW. Regional Flow Monitoring Plan submitted June 2006 & Flow Monitoring Report submitted June 2009.

* Attach documentation of work completed during the reporting period.

Based on the above information, are the Municipality and Authority in compliance with the approved schedule? Yes, except as noted (Yes/No) If no, please include an explanation.

The Authority has been prohibited from seeking additional funds (bonds), which would have enabled the Authority to carry out this work, by the Intergovernmental Oversight Board (Oversight Board) for the City of Pittsburgh, established under the Intergovernmental Cooperation Authority Act for Cities of the Second Class, Act of February 12, 2004, P.L. 73, No. 11, 53 P.S. Section 28102, et seq. In addition, the City's capital budget was essentially eliminated for FY 2005 by the Act 47 Plan Coordinator, empowered under the Municipalities Financial Recovery Act of July 10, 1987, P.L. 246, No. 47., 53 P.S. Section 11701.13 et seq. As a result of the fiscal matters referenced above, the Authority/Municipality was behind schedule on the adoption of an ordinance.

Authority Official: Environmental Compliance Coordinator
Signature/Title

January 28, 2011
Date

OSBA-I-4 Attach A

PWSA CSO Volume

2006

Allegheny River	Total CSO Volume (Mgal)	
Downtown Allegheny	66.4	
Strip District	117.12	
Two Mile Run	648.16	
Lawrenceville	428.24	
Heth's Run	309.32	
Negley Run	857.63	
TOTAL ALLEGHENY RIVER (Region 1)	**2426.87**	2426.87
Spring Garden	548.89	
East Street	235.45	
Dasher Street	65.15	
TOTAL ALLEGHENY RIVER (Region 2)	**849.49**	849.49

Monongahela River		
Downtown Monongahela	94.89	
Second Avenue	148.17	
Boundary street	571.22	
Hazelwood St.	124.96	
Nine Mile Run	275.49	
TOTAL Monongahela River Region 1	**1214.73**	1214.73
Nine Mile Run	3.79	
Arlington through 25th Street	306.9	
Becks Run	160.08	
Streets Run	164.45	
TOTAL Monongahela River Region 2	**631.43**	631.43

Ohio River		
Adams Street	101.85	
Dasher Street	0.74	
Doerr, Superior, Island Ave.	17.84	
Jacks Run	62.55	
Pennsylvania Avenue	56.83	
Woods Run	75.31	
Glen Mawr	155.98	
Saw Mill Run Inteceptor	529.47	
TOTAL Ohio River (Region 2)	**1000.55**	1000.55

Saw Mill Run		
Bausman Brook and Warrington	70.8	
Brook-line Blvd	7.24	
Edge-brook Ave	7.73	
Englert and Weyman	0.31	
Little Saw Mill Run	33.8	
McCartney Run	18.69	
McDonoughs Run	36.63	
Olympia Shaler and Woodruff Streets	17.57	
Plummers Run	229.98	
TOTAL Saw Mill Run (Region 2)	**422.35**	422.35

Chartiers Creek		
Chartiers Creek and Bells Run	137.27	
Glen Mawr	163.31	
TOTAL Chartiers Creek (Region 2)	**300.58**	300.58

TOTAL PWSA CSO VOLUME ***6846 Million Gallons***

6.846 Billion Gallons

not meeting

→ 1994 CSO Policy

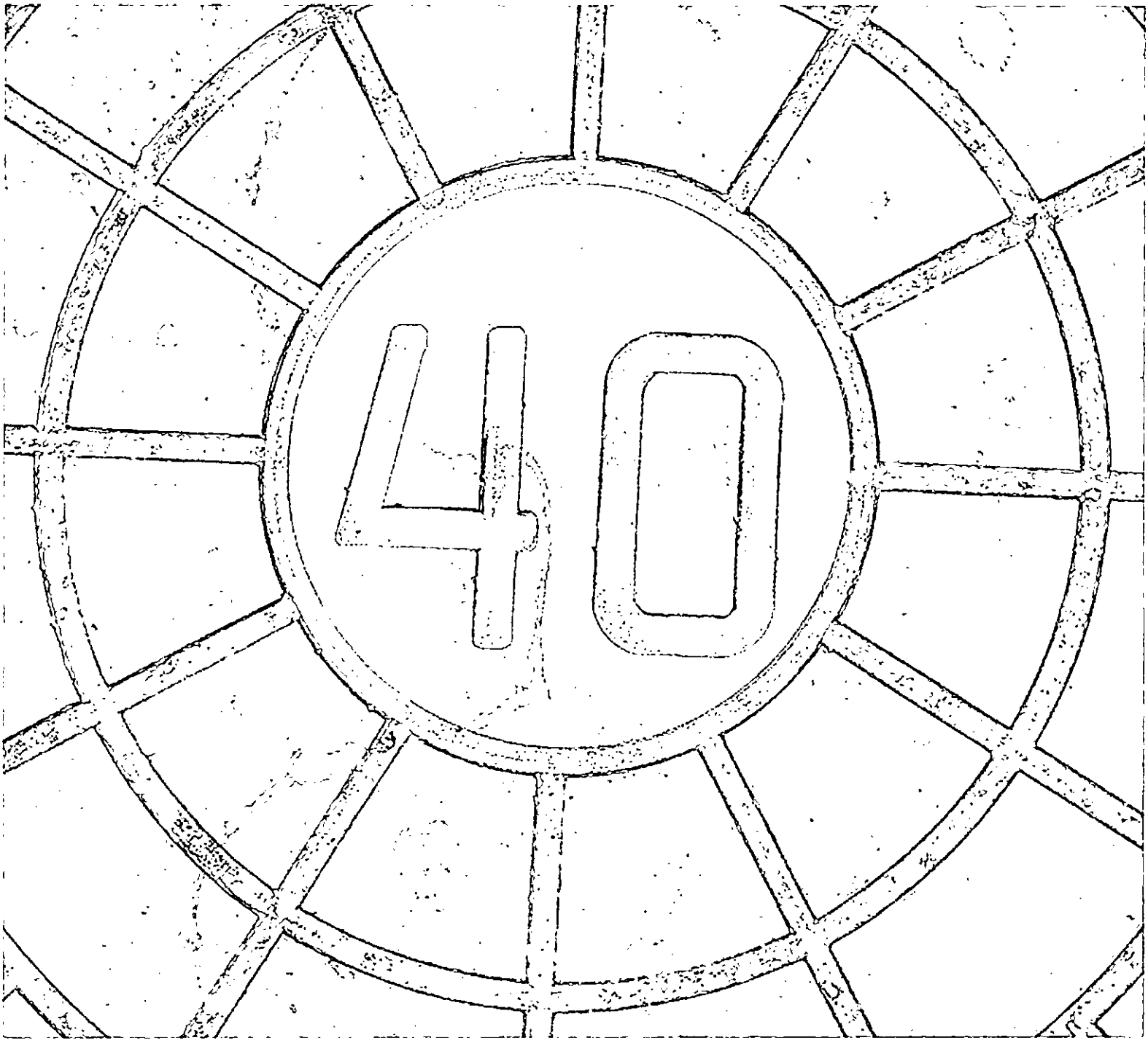
→ ~~DW~~ Dry Weather Discharges

→ Not meeting WQS.

on-lot

APPLICATION NO	SENT TO	DATE SENT	GEO ASSIGNED	DATE RETURN	APPLICANT NAME	APPLICANT ADDRESS	PHONE NUMBER	SITE ADDRESS	MUNICIPALITY	TYPE	STATUS	ACTION
C-38027	LINDA GRABOWSKI	7/15/99	INKS	9/9/1999	STEPHEN GRABOWSKI	4002 BAKERSTOWN ROAD, GIBSONIA, PA 15044		MCELHINNY ROAD	PITTSBURGH	NEW / SUBDIVISION	INACTIVE	INITIAL APPL INVOICE; READY FOR PITS; 2/7/00 INACTIVE LETTER;
S-51732	JOHN MORGAN	7/12/00	INKS	7/25/2000	JOHN MORGAN	1313 17TH STREET E, PALMETTO, FL 34221		STATION SQUARE	PITTSBURGH	HOLDING TANK	PENDING	INITIAL APPL INVOICE;
T-059855	ARTHUR BAHL		INKS	7/10/2003	ARTHUR BAHL	3854 HARPEN ROAD PITTSBURGH, PA 15214	412-831-2057	3854 HARPEN ROAD	PITTSBURGH	REPAIR	INACTIVE	07/14/03 INITIAL APPL INVOICE; 10/26/04 REFUND REQUESTED – CONNECTED TO SEWERS
V-008281	MARK TAYLOR	11/15/04	INKS	12/23/2004	OHIO CENTRAL RAILROAD SYSTEM	205 ISLAND AVENUE MCKEES ROCKS, PA 15136	412-331-6200	1529 CHARTIERS VALLEY LANE	PITTSBURGH	HOLDING TANK	INCOMPLETE	12/28/04 INITIAL APPL INVOICE & INC LETTER;

APPENDIX 2-2



APPENDIX 2-2
COST TO EXTEND SERVICE TO PA AMERICAN WATER CUSTOMERS IN THE CITY OF PITTSBURGH

CHESTER ENGINEERS

TO: M. Mckee

FROM: J. Maslanik cc: C. Jordan

DATE: March 23, 2011

SUBJECT: Conceptual Analysis of the Cost of Providing Water Service to City of Pittsburgh Customers Currently Served by PA American Water Company – Revised Per Refined Estimate of PA American Demand Rates

This memo is an update/revision of a May 5, 2008 memo that I prepared to provide a conceptual analysis of the cost of providing water service to City of Pittsburgh customers who are presently served by the pA Amercian Water Company. The initial memo was based upon a estimated 21-mgd average daily demand rate developed by extrapolating from demands in other PWSA pressure districts. Recent estimates were developed by M. McKee based upon actual metered consumption data. These estimates are more accurate and are significantly lower than the 2008 memo estimates. Therefore, the conclusions of the earlier memo were revised to reflect the lower demands.

The conceptual analysis estimated of the cost of providing the improvements to the PWSA water system required to provide water service to City of Pittsburgh customers who are currently served by the PA American Water Company. In general, this would be accomplished by taking ownership of the PA American Water Company distribution facilities within the City of Pittsburgh. Supplying these distribution facilities could also require improvements to existing PWSA facilities. This memo conceptually identifies the required improvements to the PWSA system.

OVERVIEW

A map of the PWSA water service area, the PA American Water service area in western Pennsylvania, and the portion of the PA American Water service area that lies within the City of Pittsburgh are illustrated in Figure 1. The information regarding the PA American Water service area was drawn from previous work that I had done for Allegheny County. However, I do not have any information relative to the PA American Water distribution facilities themselves.

It appears that most of the PA American Water service area within the City would be served from the Allentown District. This district is supplied by the Mission Pump Station that draws its supply from the Highland 2 Reservoir District.

ESTIMATED WATER USE BY THE PA AMERICAN CITY OF PITTSBURGH CUSTOMERS

M. McKee's procedure for estimating average daily water demands associated with the City of Pittsburgh PA American customers is summarized as follows:

- The number of PA American customers in the City ranged from 20,300 in 2005 to 24,600 in 2010.
- In 2007, metered water usage was recorded for 100% of PA American customers. In other years, only 30% to 78% of customers had recorded water use.
- the average daily metered usage in 2007 was ***4.01*** mgd for 20,305 customers or **197** gpd/customer
- Adjusted average metered usage was calculated for years other than 2007 by taking (total accounts / accounts with usage) x averaged metered usage

- Adjusted average metered usage was **3.94** mgd for the 2005 to 2010 time period. Flow contributions per customer varied from 205 gpd in 2005 to 160 gpd in 2010.

- After metered water usage is adjusted to include "unaccounted for" and "other" water uses, average water demand increases to **6.57** mgd (**3.94**/.6). This amount is significantly less that the 21 mgd average daily demand listed in the May 5, 2008 memo.

I performed an analysis of maximum day to average day pumping rates in the PWSA's Allentown Service District and determined that the ratio of maximum to average day pump rates is 1.6. Applying this factor to the 6.6-mgd average daily rate produces a maximum day rate of 10.6-mgd.

ESTIMATED IMPACTS UPON FACILITIES

Based upon the estimates presented above, providing service to the City of Pittsburgh customers who are presently being served by the PA American Water Company would increase total daily demands by approximately 6.6-mgd on an annual average basis and approximately 10.6-mgd during the maximum month. The resulting effects on the various components of the PWSA system are discussed below.

Water Supply and Treatment

During 2004 through 2007, daily water production by PWSA averaged 73-mgd. The peak day production rate averaged 99-mgd during that time period. Adding the estimated daily demand from the PA American customers would increase the average daily water production to approximately 80-mgd. Adding the estimated maximum monthly average daily demand associated with the PA American customers increases the required average daily production to 99-mgd. Including the PA American demand would increase the required the peak day production rate to approximately 110-mgd.

The current water supply allocation for PWSA is 100-mgd. **Serving the PA American customers would require an increase in the current water allocation to approximately 110-mgd.** One would not expect obtaining an increase in the water allocation to be a major cost item.

The current permitted capacity of the water treatment plant is 117-mgd. **The estimated maximum day demand rate is less than the rated plant capacity.**

Breucken Pump Station Highland 2 Pumping Equipment

Pumping rates by the Breucken Pump Station Highland 2 pumps averaged 16-mgd on an annual average basis during 2004 and 2005. The maximum month daily pumping rate for that time period averaged 19-mgd. Adding the 10.6 maximum daily demand rate for the PA American Water Pittsburgh distribution system increases the pumping rate to 30-mgd. The nominal total pumping capacity of all of the Breucken Highland 2 pumps is 72-mgd. The capacity with one pump out of service is 48-mgd.

The capacity of the Breucken Pump Station Highland 2 Pumping equipment is adequate to supply the estimated PA American customer demands.

Highland 2 Reservoir

The nominal storage capacity of the Highland 2 Reservoir is 125-mg. At the estimated 45-mgd maximum month daily pumping rate into the Highland 2 District (including the PA American demands), the reservoir provides more than 3.75 days of storage. This more than satisfies the general 1-day storage requirement.

The capacity of the Highland 2 Reservoir is sufficient to provide for the estimated PA American customer demands. Moreover, the added demand may improve system performance relative to disinfection byproducts production by reducing residence time in the storage facility.

Highland 2 Transmission Mains

No detailed hydraulic analysis was performed regarding the Highland 2 transmission mains. However, it is not anticipated that improvements to the system of transmission mains would be required. The Highland 2 Reservoir is supplied by two 48-inch rising mains. Under the 45-mgd pumping rate, velocities in the mains will approximate 2.8-fps, an acceptable operating condition. **Therefore, the capacity of the rising mains is expected to be adequate.**

The Mission Pump Station is fed by a network of transmission mains, ranging in size from 16- to 50-inches in diameter. The main feed north of the Monongahela River is a 50-inch transmission main. The maximum month daily demand rate for the combined Allentown plus PA American Pittsburgh service areas is 19-mgd (10.6-mgd PA American Water service area + 8-mgd Allentown District). Even assuming that all of this demand is provided through the 50-inch main, flow velocities will remain below 3-fps. **Considering this and the fact that other mains supply this area, it is anticipated that the capacity of the transmission mains north of the Monongahela River will be adequate**.

The primary feeds to the Mission Pump Station in the South Side are through two 36-inch crossings of the Monongahela River and two 30-inch suction mains. There is the potential for some supply through a connection with the Lanpher District via a crossing of the Ohio River. However, this is considered a secondary feed in this analysis. At the 19-mgd Allentown and PA American Pittsburgh systems demand rate, the velocity in the 36-inch mains will approximate 2.0-fps and roughly 3.0-fps in the 30-inch suction mains. These flow velocities are well within typical design standards, indicating that the river crossings have sufficient capacity.

Mission Pump Station

The Mission Pump Station contains five pumps with a total nominal pumping capacity of 38-mgd. The nominal pumping capacity with the largest pump out of service is 26-mgd. The 19-mgd Allentown and PA American Pittsburgh service areas demand is within the total nominal pumping capacity.

Mission Pump Station Rising Mains

The Allentown Tanks are fed by the Mission Street Pump Station through two 30-inch rising mains. At the 19-mgd demand rate, flow velocities will approximate 3.0-fps. These flow velocities are well within typical design standards.

PA American Pittsburgh System Distribution

We do not have any information relative to the PA American water distribution facilities. Therefore, it is not possible at this point to identify specific improvements that will be required in order to incorporate that system into the PWSA system. However, for the purposes of this analysis, the following assumptions have been made. Clearly, a detailed hydraulic analysis of the PWSA and PA American distribution systems will be required in order to identify specific recommended improvements.

1. A pump station will be required in order to serve the entire system. Figure 3 illustrates the service area and identifies elevations that lie above the service elevation of the Allentown District (1,215-feet). This service elevation represents the elevation above which static pressures would fall below approximately 35-psi with the Allentown Tanks at approximately the 80% full level. As is indicated in Figure 3, there area substantial areas of the PA American Pittsburgh service district that lie above elevation 1,215-feet. Therefore, a pumping station will be required in order to serve the entire service district. The approximate location of the pump station is indicated in Figure 3.

2. A set of transmission mains will be required to supply the existing distribution system. A likely arrangement of such mains would consist of a transmission main creating a loop from the point of

supply in the eastern portion of the Allentown district, traversing the PA American Pittsburgh service district and connecting to the western end of the Allentown district. Separate transmission main legs would be extended to reach other areas of the PA American Pittsburgh service district. The existing PA American Pittsburgh service district distribution mains would be fed from connections to be made to the transmission mains. A conceptual layout of transmission mains through the PA American service district is provided in Figure 2. Available information is insufficient to size the mains at this time.

3. Additional system storage will be required. The total annual average daily demand for the combined Allentown and Pa American Pittsburgh service districts is estimated to be 11.5-mgd (4.9-mgd Allentown + 6.6-mgd PA American) . Using the 1-day of storage guideline, the total system storage requirement is 11.5-mg. The existing Allentown Tanks provide 6-mg of storage volume. Therefore, by this measure, an additional 5.5-mg of system storage is required. It is not known how much storage tank volume currently exists in the PA American. For the purpose of this analysis it is assumed that all of this storage volume will have to be provided. It is also anticipated that the storage would be provided within the PA American Pittsburgh service district upstream of the pump station. Conceptual potential locations for such storage facilities are indicated in Figure 2. The locations were identified solely based upon elevation and existing development factors drawn from the Allegheny County GIS topographic and building footprint databases.

The identified general required improvements associated with the PA American Pittsburgh service are distribution system are a new pump station, a network of transmission mains with connections to the existing distribution system, and approximately 5.5-mg of storage facilities.

The following two additional issues will also need to be addressed, evaluated and resolved. However, we do not have sufficient information to address them at this time.

1. Unless PWSA also serves Mt. Oliver at the time it acquires the PA American Pittsburgh system, provisions will have to be made to maintain connectivity between Mt. Oliver and the remaining PA American system. It is not clear from the limited information available how that can practically be accomplished.

2. Consideration must be given to how the rest of the PA American Water system will operate if the Pittsburgh portion of the system is assumed by PWSA. It is probable that connectivity of the overall system is currently maintained at least to some degree with piping contained within the City portion of the PA American system. The ultimate configuration of the piping must be able to accommodate the continued operation of the rest of the PA American system.

SUMMARY OF IDENTIFIED REQUIRED IMPROVEMENTS AND CONCEPTUAL COST ESTIMATES

Table 2 contains preliminary, conceptual cost estimates for the identified improvements required to facilitate service to the PA American Pittsburgh service area. These costs are very preliminary estimates based upon PWSA experience with generally similar projects, including allowances for the uncertainties inherent in this analysis.

Table 2
Preliminary Conceptual Cost Estimates for Improvements Required to Facilitate Service to the PA American Pittsburgh Service Area

Item	Quantity	Unit Cost	Estimated Construction Cost	Estimated Total Project Cost
Increase water allocation	increase to approximately 130-mgd	n/a	n/a	n/a
Upsize/improve Mission Pump Station	Nominal capacity approximately 34-mgd	lump sum	$10,000,000	$12,500,000
Construct PA American Pittsburgh service area pump station	Nominal capacity approximately 26-mgd	lump sum	$10,000,000	$12,500,000
Construct PA American Pittsburgh service area transmission mains and connections to distribution grid	103,000-feet	$350/foot	$36,100,000	$45,100,000
Construct distribution system storage facilities	5.5-million gallons	$1.5/gallon	$8,500,000	$11,000,000
Total			**$54,600,000**	**$68,600,000**
* unit cost for Mission Pump Station suction piping includes allowance for river crossing				

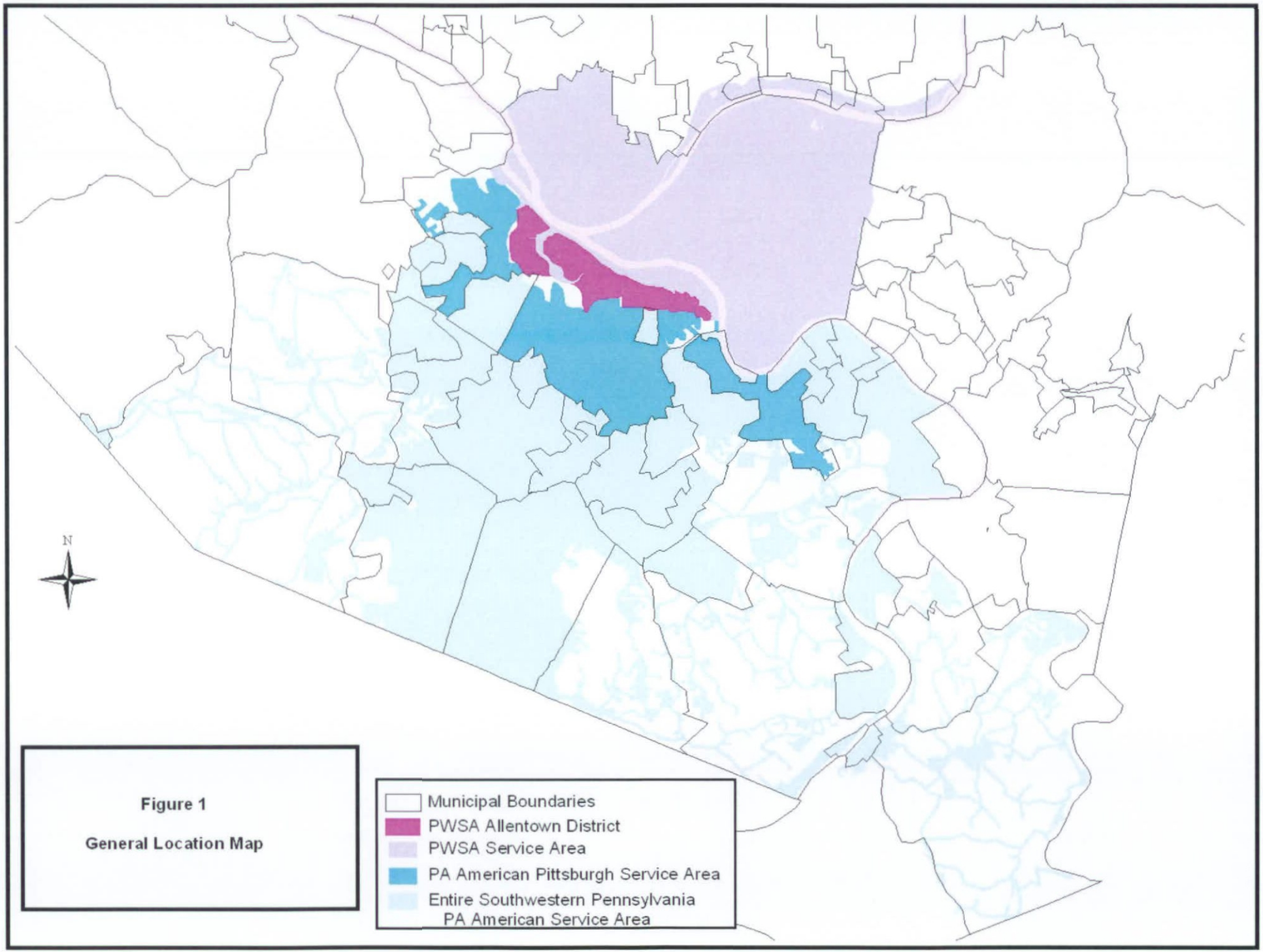


Figure 1

General Location Map

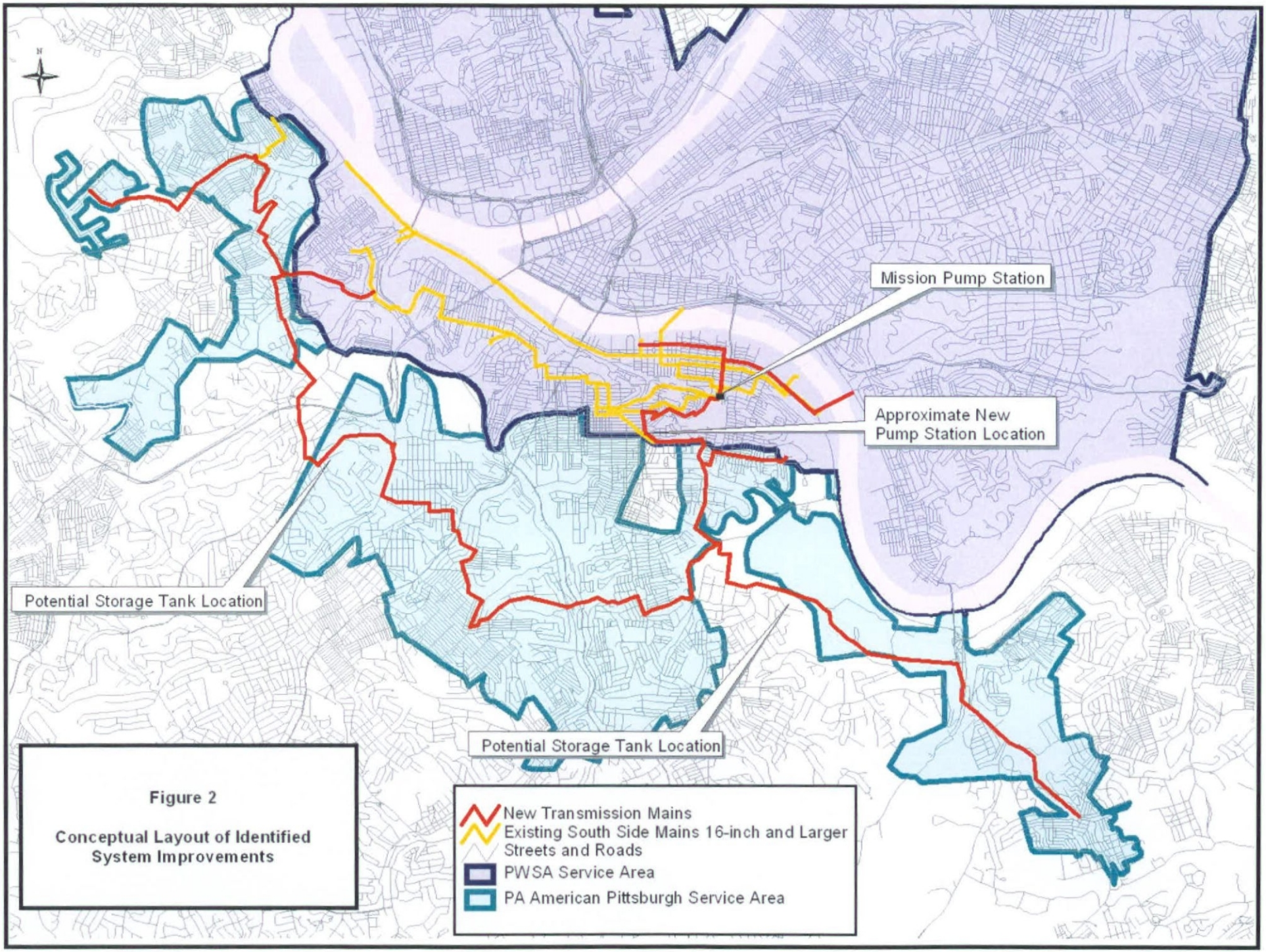


Figure 2

Conceptual Layout of Identified System Improvements

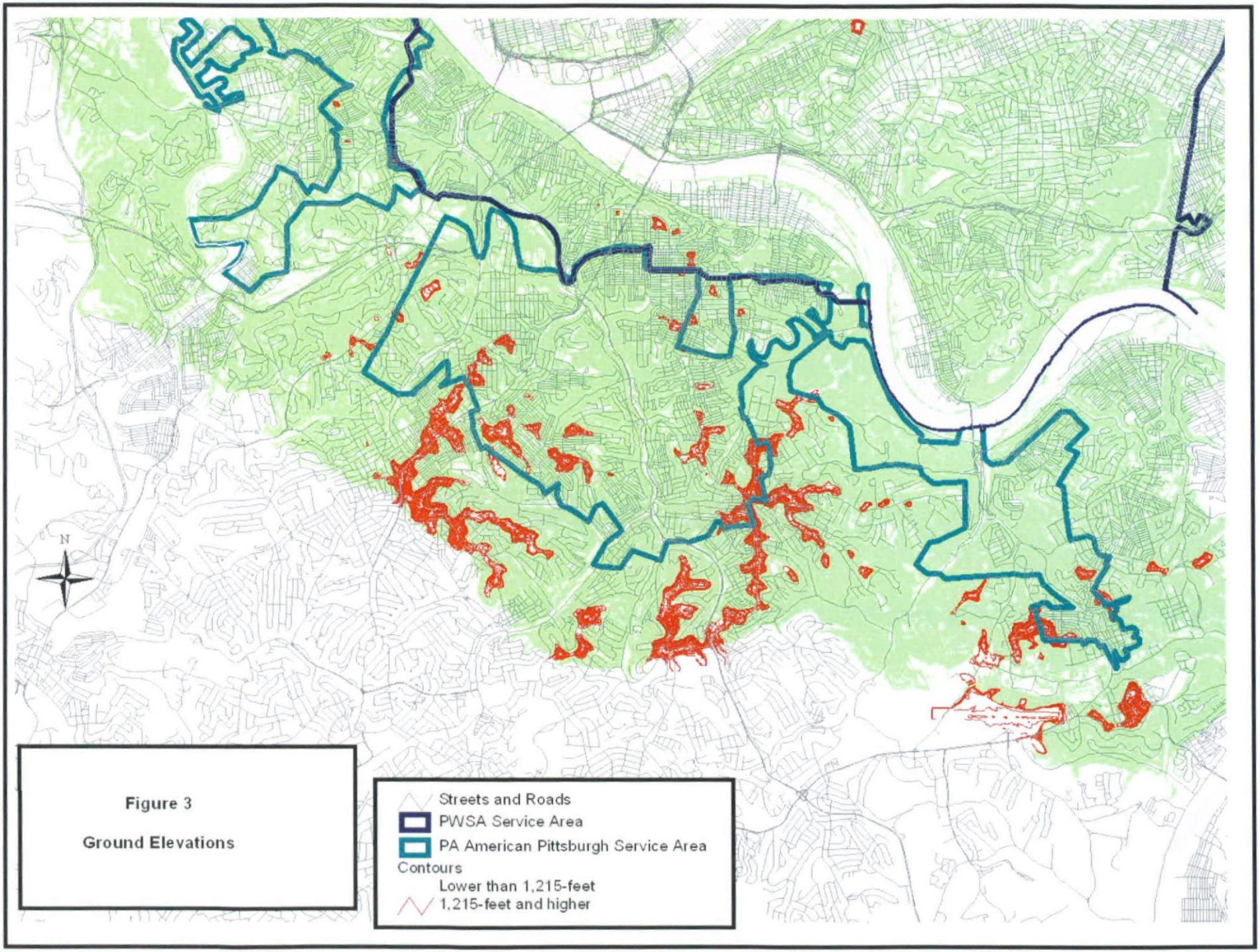

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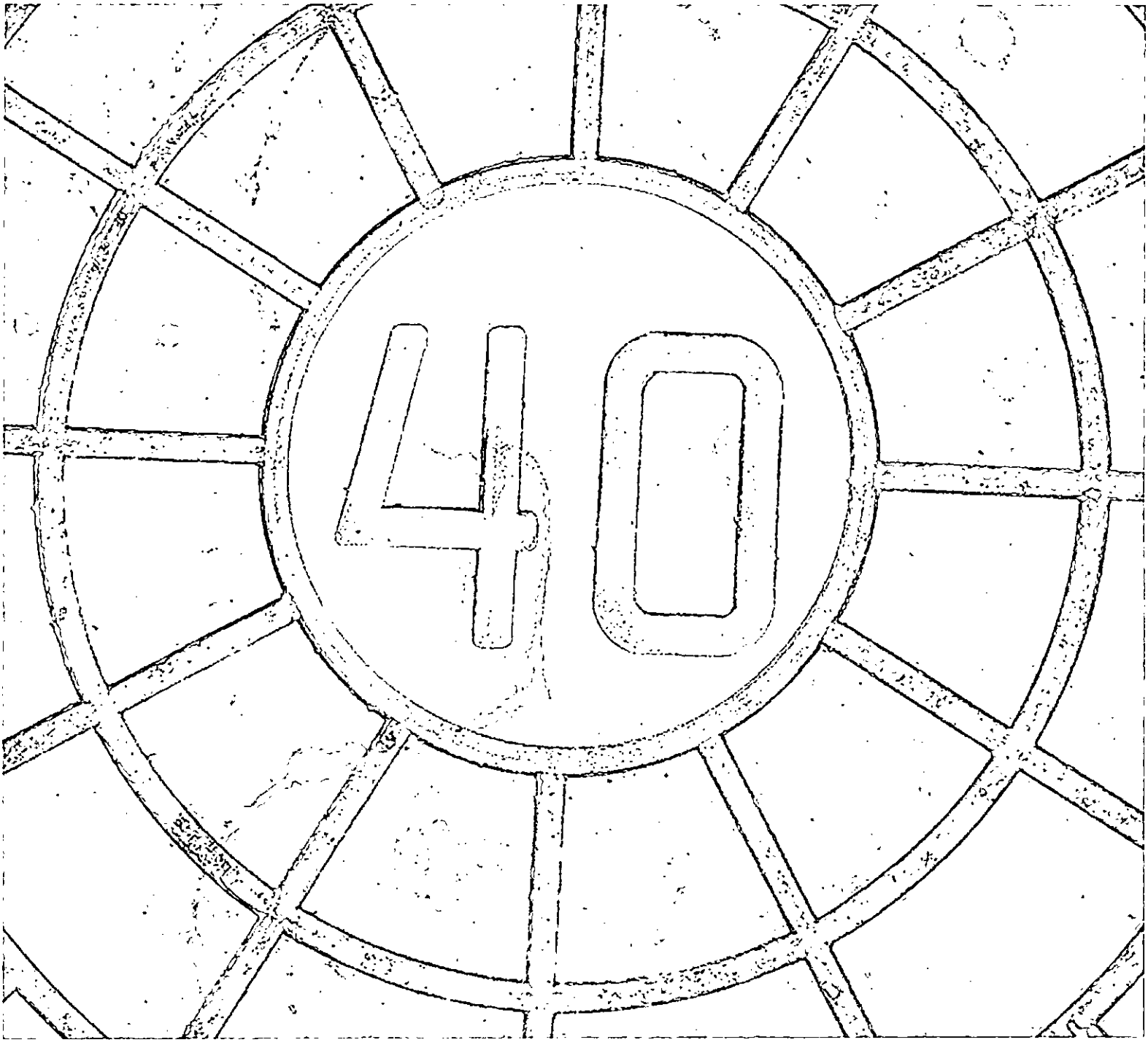
Figure 3
Ground Elevations
Streets and Roads
PWSA Service Area
PA American Pittsburgh Service Area
Contours
Lower than 1,215-feet
1,215-feet and higher

APPENDIX 3-1



Appendix 3-1

Water System Information

Waterline Information From GIS

Pipe Diameter (Inches)	Pipe Length (Feet)	Percent	Cumulat. Percent
1	3,542	0.07%	0.07%
2	18,670	0.35%	0.42%
4	175,022	3.28%	3.69%
6	2,469,029	46.23%	49.92%
8	1,099,859	20.59%	70.52%
10	92,308	1.73%	72.25%
12	566,140	10.60%	82.85%
15	18,166	0.34%	83.19%
16	253,550	4.75%	87.93%
18	1,058	0.02%	87.95%
20	209,148	3.92%	91.87%
24	85,857	1.61%	93.48%
30	117,803	2.21%	95.68%
36	82,812	1.55%	97.23%
42	24,481	0.46%	97.69%
48	16,150	0.30%	97.99%
50	36,300	0.68%	98.67%
60	56,167	1.05%	99.72%
66	2,170	0.04%	99.77%
72	3,715	0.07%	99.84%
84	3,873	0.07%	99.91%
90	50	0.00%	99.91%
96	4,361	0.08%	99.99%
120	524	0.01%	100.00%

Total * 5,340,755
Miles 1,011.51

* Excludes Abandoned Lines

Pipe Age Distribution

From Year	To Year	Length (feet)	Percent	Cumulat. Percent
1887	1890	28,725	0.56%	0.56%
1891	1900	218,763	4.30%	4.86%
1901	1910	633,419	12.45%	17.31%
1911	1920	334,711	6.58%	23.89%
1921	1930	765,743	15.05%	38.94%
1931	1940	648,178	12.74%	51.68%
1941	1950	300,709	5.91%	57.59%
1951	1960	219,157	4.31%	61.90%
1961	1970	616,592	12.12%	74.02%
1971	1980	641,219	12.60%	86.62%
1981	1990	143,998	2.83%	89.45%
1991	2000	214,129	4.21%	93.66%
2001	2010	323,345	6.35%	100.00%

Total 5,088,689

6.00% of waterlines (by length) have age in GIS
Oldest Pipe 1887 124 years old
Useful life for pipe 70 years
Pipe installed before 1941 will have no value in system valuation

2,629,539 LF waterlines installed before 1941
51.67% of pipes in system

Appendix 3-1 (continued)

Water System Information

Valve Information From GIS

Valve Size (inches)	Quantity	Percent	Cumulat. Percent
1	11	0.04%	0.04%
2	109	0.43%	0.47%
4	609	2.40%	2.88%
6	14,722	58.12%	61.00%
8	5,703	22.51%	83.51%
10	364	1.44%	84.95%
12	2,363	9.33%	94.28%
15	38	0.15%	94.43%
16	545	2.15%	96.58%
18	4	0.02%	96.60%
20	321	1.27%	97.86%
24	189	0.75%	98.61%
30	154	0.61%	99.22%
36	93	0.37%	99.59%
42	32	0.13%	99.71%
48	51	0.20%	99.91%
50	8	0.03%	99.94%
60	11	0.04%	99.99%
72	2	0.01%	100.00%
96	1	0.00%	100.00%

Total 25,330

Total Excludes 1,539 Abandoned and 3,307 Active Private Valves

Valve Types From GIS

Description	Number	Percent
Ball Valve	3	0.01%
Butterfly valve	145	0.57%
Cone Valve	7	0.03%
Gate Valve	19,236	75.94%
Hydrant Valve	5,709	22.54%
Air Gap	1	0.00%
Air Control	139	0.55%
Unknown	27	0.11%
Atmospheric Vacuum	2	0.01%
Altitude	2	0.01%
Double Check	3	0.01%
Pressure Vacuum	3	0.01%
Red. Press. Vacuum	2	0.01%
Simple Check	20	0.08%
Vacuum Release	9	0.04%
Regular	22	0.09%

Total 25,330 100.00%

Valves with ages in GIS 7.1%

Oldest Valve Install Date	1887
Useful Life for Valve (years)	70
Cut-Off Date for Useful Life	1941
Valves Installed Before 1941	50.3%

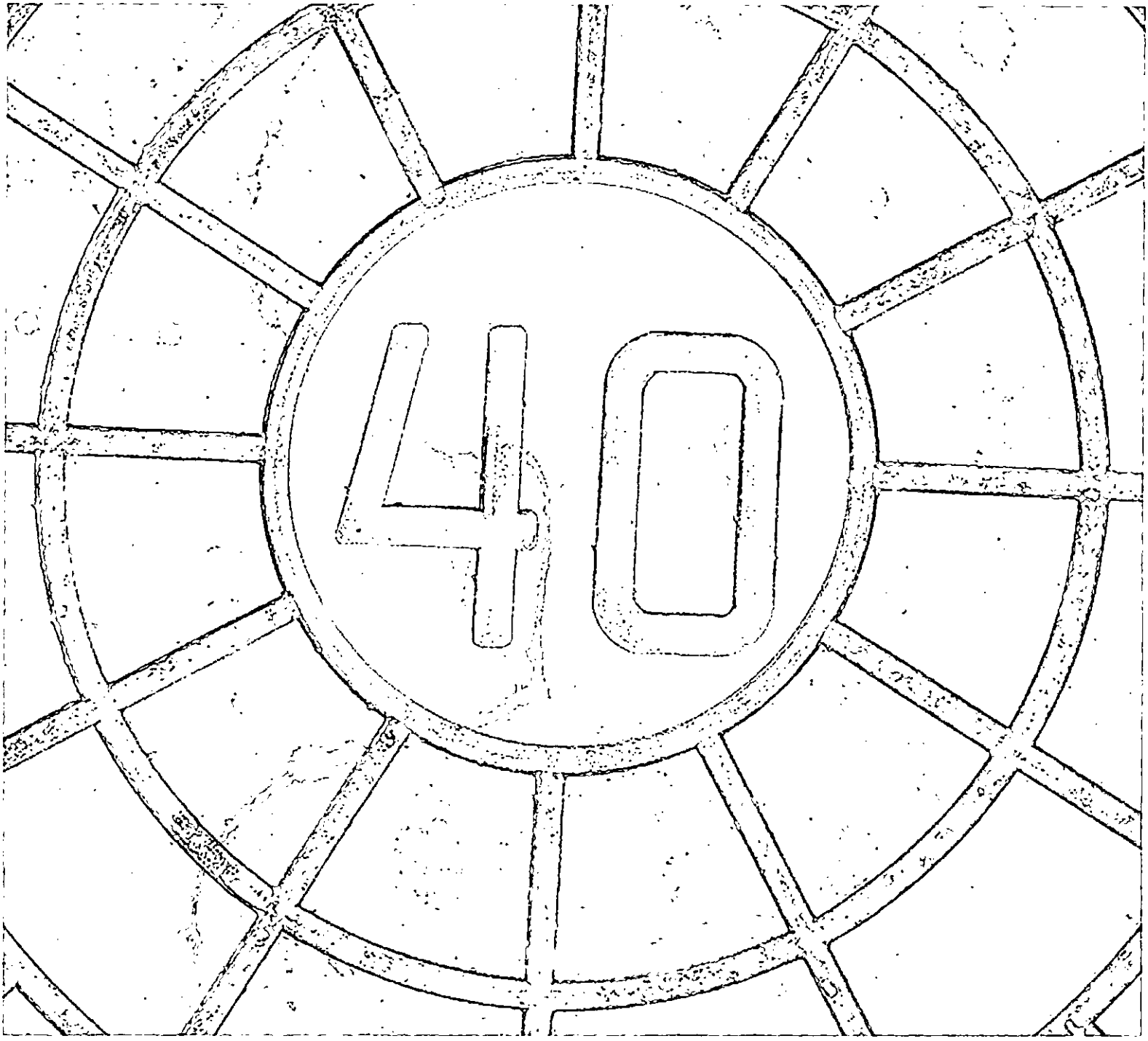
Fire Hydrant Information From GIS

Size	Quantity	Percent
4	85	1.12%
6	7,458	98.68%
8	10	0.13%
12	5	0.07%

Total 7,558 100.00%

No age information for hydrants in GIS

APPENDIX 3-2



APPENDIX 3-2
SEWER SYSTEM INFORMATION FROM GIS

Appendix 3-2

Sewer System Information

Sewer Line Information From GIS

Pipe Diameter	Pipe Length	Percent
3	84	0.00%
4	1,807	0.03%
4.8	24	0.00%
5	27	0.00%
6	2,984	0.05%
7.2	34	0.00%
7.8	17	0.00%
8	776,684	12.14%
9	43,494	0.68%
9.6	24	0.00%
10	98,975	1.55%
11	18	0.00%
12	650,606	10.17%
13	71	0.00%
14	417	0.01%
14.4	39	0.00%
15	2,770,241	43.32%
15.6	16	0.00%
16	1,121	0.02%
16.8	261	0.00%
18	570,076	8.91%
19.2	11	0.00%
20	249,204	3.90%
20.4	25	0.00%
21	24,376	0.38%
22	1,366	0.02%
24	337,942	5.28%
27	14,213	0.22%
29	354	0.01%
30	136,386	2.13%
31	1,452	0.02%
33	24,082	0.38%
34	917	0.01%
35	841	0.01%
36	184,933	2.89%
37	339	0.01%
38	1,880	0.03%
39	9,595	0.15%
39.5	1,334	0.02%
40	2,879	0.05%
42	79,174	1.24%
44	725	0.01%
45	5,549	0.09%
46	45	0.00%
48	87,391	1.37%
50	2,169	0.03%
51	2,623	0.04%

Pipe Diameter	Pipe Length	Percent
52	526	0.01%
53	2,498	0.04%
54	51,472	0.80%
56	1,227	0.02%
57	7,887	0.12%
58	493	0.01%
60	44,271	0.69%
64	948	0.01%
66	24,926	0.39%
68	8,555	0.13%
69	4,057	0.06%
70	1,486	0.02%
72	52,708	0.82%
74	157	0.00%
75	3,868	0.06%
78	19,011	0.30%
81	2,775	0.04%
81.5	1,991	0.03%
82	1,032	0.02%
84	9,551	0.15%
85.5	1,948	0.03%
86	1,669	0.03%
87	658	0.01%
88	629	0.01%
89	1,149	0.02%
90	3,584	0.06%
91	3,933	0.06%
93	1,706	0.03%
94	623	0.01%
96	17,038	0.27%
97	511	0.01%
97.5	2,204	0.03%
98	582	0.01%
99.6	617	0.01%
101	1,231	0.02%
102	7,675	0.12%
105	848	0.01%
106	600	0.01%
108	6,117	0.10%
114	2,693	0.04%
120	2,832	0.04%
129	1,416	0.02%
132	1,150	0.02%
135	495	0.01%
141.3	5,111	0.08%
144	1,015	0.02%
168	1,028	0.02%

7.4% of sewers with installation date
1900 oldest sewer

Total 6,395,326 100.00%
1,211.24 miles

Appendix 3-2 (continued)

Sewer System Information

Manhole Information From GIS

Type	Number	Percent
Lamphole	353	1.2%
Manhole Equalizing Chamber	17	0.1%
Manhole Flow Divider	12	0.0%
Manhole	28,702	98.7%

Total 29,084 100.0%

9.90% MHs with install date in GIS
1900 oldest MH

Inlet Information From GIS

Type	Subtype	Number	Percent
Catch Basin	Type 1	8,590	35.6%
	Type 5	166	0.7%
	Type 9	1,851	7.7%
	Type 10	15	0.1%
	Type 11	2,713	11.2%
	Other	792	3.3%
	None	560	2.3%
Headwall	Other	1	0.0%
	None	4	0.0%
Inlet	Type 1	295	1.2%
	Type 5	8	0.0%
	Type 9	41	0.2%
	Type 11	112	0.5%
	Other	31	0.1%
	None	3,201	13.3%
Storm Inlet	Type 1	1,224	5.1%
	Type 5	173	0.7%
	Type 9	1,622	6.7%
	Type 10	5	0.0%
	Type 11	1,903	7.9%
	Other	769	3.2%
	None	67	0.3%

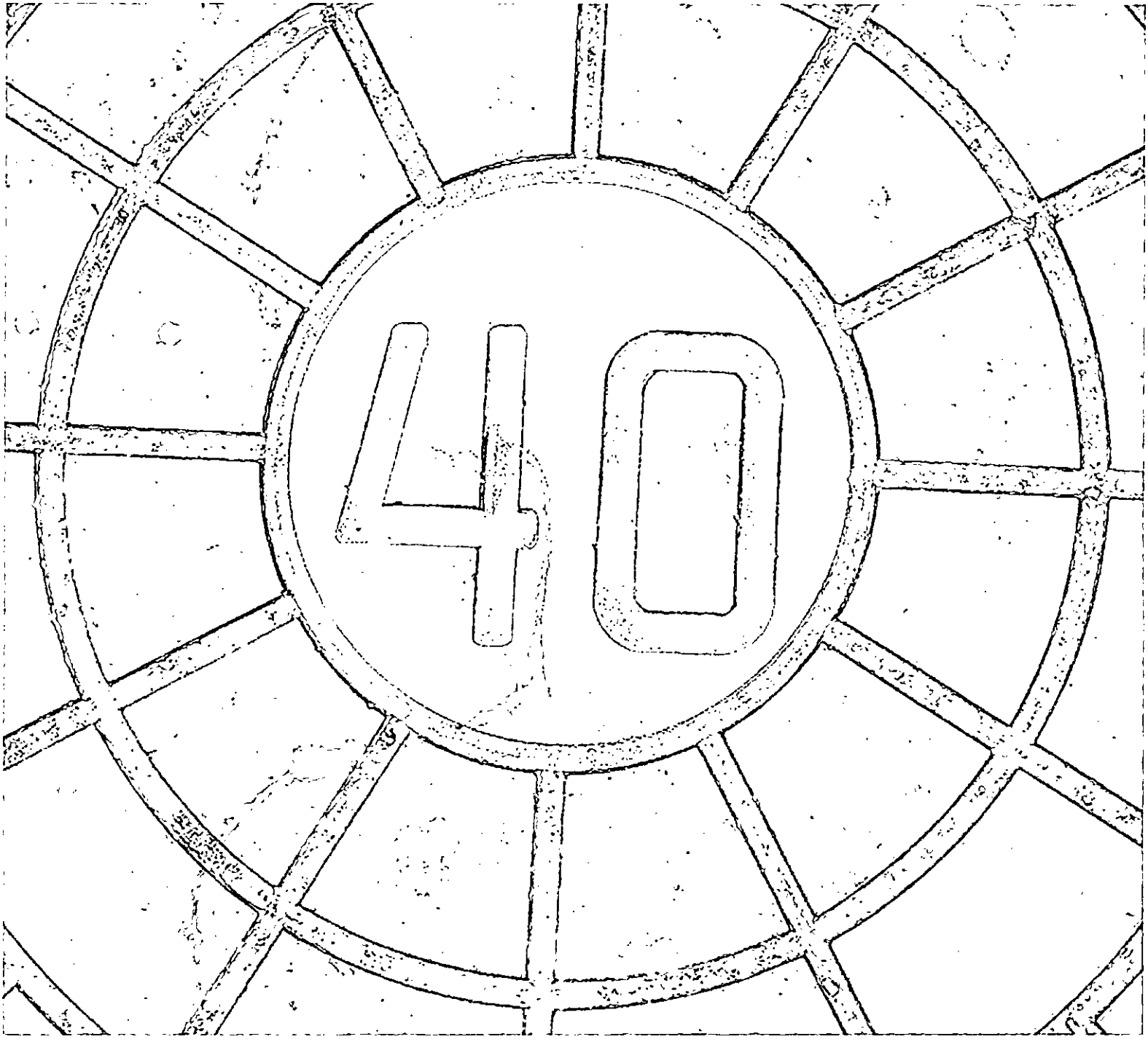
Total 24,143 100.0%

5.2% inlets with install date in GIS
1919 oldest inlet

Diversion Structure Information From GIS

99 diversion structures
46.5% with install date in GIS
1922 oldest diversion structure

APPENDIX 3-3



OSBA-I-4 Attach A

WATER WORKS

Design and Construction of the North Side Reservoir of the Pittsburgh Water Works.

The new North Side (Cabbage Hill) reservoir of the Pittsburgh water works is located about six miles from the point section of the city. The flow line elevation is 275 ft., Pittsburgh datum, and is the same as that of the lower Highland Park reservoir which supplies that portion of the central city along both rivers, and the entire South Side.

The reservoir is of 160,000,000 gals. capacity with a water area of 17 acres and a water depth of 38 ft. It has been built by the cut and fill method, three sides being built of rolled embankment, the remaining side being entirely in cuts, surrounded by a reinforced concrete retaining wall along a public roadway. The reservoir is divided into east and west basins by a reinforced concrete dividing wall 18 ft. high, containing the inlet conduit which connects the main, or inlet and outlet gate house in the northerly embankment, with the distribution or secondary gate house in the southerly slope.

The objects of the reservoir are: (1) To replace the old, small and unsafe Troy Hill reservoir in the supply system of the North Side (formerly Allegheny); and (2) to act as an equalizer in conjunction with Highland No. 2 Reservoir. The main distribution feeder mains from both reservoirs are to be cross-connected by a 48-in. steel main under the Allegheny River. The design and construction of the reservoir are here described from information taken from a paper by E. E. Lanpher and J. S. Cole before the Engineers' Society of Western Pennsylvania. The full paper and discussion are in the October, 1914, Proceedings.

In 1896 the former city of Allegheny laid a 60-in. steel water main from its pumping station on the Allegheny River, a distance of about 8.6 miles, to the Troy Hill reservoir. At Etna this main deviated north from the river over a divide and thence back to the river bank near Millvale.

The new North Side reservoir is constructed on this divide, so that the toe of the northerly embankment is bounded by the water main. Allegheny had intended to construct such a reservoir about one-third mile north, and about 100 ft. higher than the present reservoir, and installed two Y's and valves on this main about one-half mile apart and looking toward the higher elevation. These Y's and valves were of great value in the connecting of the new reservoir to the supply main, without interfering with the water supply, inasmuch as the 60-in. main was the sole source of water supply of the North Side.

The reservoir is constructed from designs and specifications prepared in the Division of Engineering and Construction of the Bureau of Water, and contract was awarded upon the unit price basis, July 6, 1912, to the John F. Casey Co. The contract price was $681,976.

EXCAVATION AND EMBANKMENTS.

Work of clearing the site was started July 20, 1912. Preparatory to embankment work, the entire site of 24 acres was cleared of all vegetable growth and the top soil removed to storage piles. Good foundation for embankment was found in most places at a depth of about 18 ins. All embankment material was obtained from excavation in the basin and consisted mainly of first class clay of several shades, and of easily broken stone of shale formation, although in some cases low grade dynamite was used to facilitate digging. Most of this shale disintegrated rapidly when exposed to the atmosphere. A mixture of the clay and shale spread in layers of 6 ins. or less, and rolled with grooved rollers of two tons per foot produced a very hard, impervious embankment, but it was necessary to pass the roller over each layer at least six times to thoroughly compact the soil, and to further break the small stones. (There are no stones in the embankment larger than 4 ins. in diameter.)

Three steam shovels with 3, 1½, and ½ cu. yd. dippers respectively and a McMyler crane were used in excavating, the larger shovels working efficiently in the shale. Four contractor's engines and 50 dump cars, of 4 cu. yds. capacity, were used in conveying the material to the embankments. An engine operated spreader, two road graders and four 16-ton rollers were used in spreading and rolling the embankments. The maximum yardage excavated and rolled in embankment in one day of 11½ hours, was 3,500 cu. yds.

The embankments have a slope on the outside of 2 to 1 for a height of about 20 ft., where there is a 5-ft. berm. Above this berm the slope is 1¾ to 1 for a height of 20 ft. On the inside, the slope is uniform at 2 to 1 from the bottom to the top, the height being about 42 ft. above the floor of the basins. The outside of the embankment was scored and covered with 6 ins. (measured vertically) of top soil, which is seeded and sodded. This top soil was dumped from the top of the embankment, graded and rolled, a horse operated roller being used.

The top of the embankment is 15 ft. wide, while the maximum width of the foot of the embankment is 185 ft.

STEEL PIPE AND CONNECTIONS.

In order to maintain the supply through the single 60-in. main and make the difficult connections to the main gate house, about one-half mile of 60-in. riveted steel main of ⅜-in. plate was laid parallel to, and connected to the Y's left in the old main. From these two mains two 60-in. steel inlet pipes and two 60-in. steel outlet pipes were installed to the main gate house in the northerly embankment. Both 60-in. mains are equipped with Venturi meters (30-in. diameter of throat) consisting of cast iron up-stream ends, bronze throat pieces and reinforced concrete tail pieces. These tail pieces were built in place and at ten days were subjected to a 90-lb. pressure test, showing no signs of leakage.

The 70-ton traveling crane was used in connection with all of the steel pipe work, no tripods being used. Even the excavation was done by this crane with an orange peel bucket. A 300-ft. length of 60-in. pipe was laid in one day, the major portion of it being riveted. At one time it became necessary to shut off the water in the old main, cut out the rivets of three joints, remove 125 ft. of the pipe, replace a portion of this pipe with one section containing a bulkhead and rivet this section to the pipe in place; all of which was done in four hours.

Riveted steel Y's and Tees of ½-in. plate were used in place of the usual cast iron specials.

MAIN AND SECONDARY GATE HOUSES.

The main gate house foundation is a reinforced concrete structure, 42 x 38 ft. in plan, extending from bed rock to the top of the northerly embankment. Water enters through the two inlet pipes at elevation 242.5, and rises in the inlet wells and flows over weirs at elevation 271 into two inlet chambers controlled by stop planks, thence through the main inlet chamber again controlled by stop planks to a 7-ft. reinforced concrete conduit through the embankment and directly across the reservoir to the secondary gate house in the southerly slope. The secondary gate house is a well 24 ft. 6 ins. x 11 ft. 3 ins. in plan, into which the water enters at reservoir floor elevation, rises to elevation 263.90, where it is passed through 5-ft. circular sluice gates to distributing conduits in both basins. The water again re-enters the main house through two 5-ft. reinforced concrete conduits, passing directly through the gate house to the two outlet pipes. Both outlet channels through the gate house are controlled by 6-ft. x 3½-ft. sluice gates in addition to stop planks on both sides of each sluice gate.

The main gate house is so arranged that water may be passed from the inlet pipes to the inlet chambers, to the outlet chambers and outlet pipes, without entering the reservoir. Water may be drained from either basin to the main drain through 3-ft. x 2½-ft. sluice gates in the outlet chambers.

The main gate house was poured in two horizontal sections and five vertical sections, and contains approximately 800 cu. yds. of concrete mixed in a 1-cu. yd. batch mixer, electrically operated, all material being handled by the traveling crane.

The superstructures of these gate houses are not included in the present contract.

DRAINAGE SYSTEM.

In the main gate house a waste weir at elevation 275 is provided against overflowing, the water being carried to the main drain which is a 36-in. circular conduit approximately 2,300 ft. long, running parallel to the main pipe lines to a small stream discharging into the Allegheny River. Into this drain also discharges surface water from a 3 x 2-ft. egg shaped concrete drain, extending along the roadways on the southerly and easterly sides and a 12-in. and 18-in. tile drain extending along the westerly and northerly sides of the reservoir. Along the southerly, or hillside, portion of the reservoir, between the Friday avenue wall and the roadway, a ground water cut-off drain was installed consisting of a 6-in. open joint tile pipe in a 30-in. trench, the trench being filled with gravel to the surface. This tile pipe is at elevation approximately 255, or about 18 ft. above the floor of the basins, and failed to cut off all ground water as was shown when excavation proceeded to grade. This condition caused the construction of shallow diagonal drains under the floor system along the easterly and southerly slopes as nearly perpendicular as possible to the direction of ground water flow as determined by observations from a system of test wells. These diagonal or herring-bone drains carry the water to main collector drains along the toe of the southerly slope, and thence to two 8-in. main drains under the dividing wall and through the embankment to the waste drain in the gate house. All of the collecting drains consist of 4-in. and 6-in. open joint tile surrounded by gravel, all covered by a 12-in. concrete cap which forms a foundation for the floors. The 8-in. drains are surrounded by concrete to prevent upward pressure on the base of the dividing wall.

Steel forms were used for the 36-in. main drain and part of the egg drain, and both drains were poured in two sections, except where the main drain was reinforced near the gate house. In the deep trench of the cut-off drain an A-frame movable crane with hoisting drums was used to remove excavated materials. Concrete in drains was mainly hand mixed. These drains were constructed mainly in cold weather, making it necessary to heat the sand and gravel, and to maintain fires in the trenches.

FRIDAY AVENUE RETAINING WALL.

The reinforced concrete retaining wall, extending for 875 ft. along the southerly side of the reservoir and holding in place a public roadway, is built at the top of the 2 to 1 slope and varies in height from 2 to 21¾ ft. The heel of the wall is tied into a 2x3-ft. egg shaped drain for stability. The vertical section of this wall is 18 ins. thick. The foundation extends 2 ft. in front and in the higher sections 9 ft. back of the face of the wall.

The vertical reinforcing of the higher sections of the wall consists of ⅝-in. rods on 16-in. centers from the top to the base, ⅝-in. rods on 8-in. centers from a point 10 ft. below the top of the base, ⅝-in. rods on 4-in. centers from a point 12 ft. below the top to the base,

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and in addition, ¾-in. rods on 10-in. centers through the base and the top of the egg drain, and ⅝-in. rods on 12-in. centers extending from the base both sides of the egg drain, with additional short rods at construction joints.

The base of this wall was constructed in 8-ft. sections because of interference of the bracing that held the roadway in place, while the wall proper was built in 48-ft. sections, or from one galvanized plate expansion joint to another.

After this wall had been practically completed and the slope trimmed, a slippery clay was exposed, showing that a general movement of the wall would probably follow the back-filling. A large toe pier or buttress was therefore constructed below and in front of the base of the retaining wall and extending to the rock, increasing the stability of the wall against sliding from 0.98 to 1.50 as computed from Baker's formula with a coefficient of 0.25 for the sliding of clay on clay. By working the concrete dry a close joint was made between the toe pier and the base of the wall, no sulphur, lead or wedges being used.

Concrete for the wall and toe pier was mixed along Friday avenue in a ½-cu. yd. batch mixer; the A-frame traveling crane being used in the handling of the forms and in the backfilling.

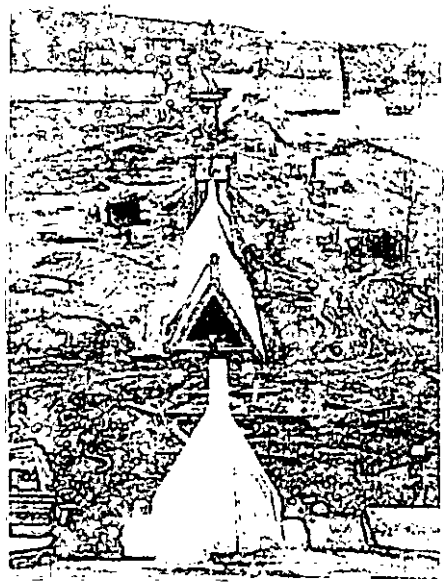

Fig. 1. View of Combined Dividing Wall and Inlet Conduit of North Side Reservoir, of Pittsburgh, Under Construction.

DIVIDING WALL AND CONDUIT.

The original design of the reservoir provided for an earth dividing embankment surmounted by a 7-ft. reinforced concrete inlet conduit extending between the two gate houses. Inability to obtain sufficient clay to mix with the shale for outside embankment purposes caused the substitution of a combined dividing wall and conduit for the dividing embankment and circular conduit. A view of the dividing wall and conduit is shown in Fig. 1.

The conduit wall is a triangular conduit of an area equivalent to a 7-ft. circle, supported on two legs or cut-off walls extending from 5 to 9 ft. below the floor to bed rock, all surmounted by an 18-in. wall about 5 ft. high, making the height of the conduit wall 16 ft. above one basin floor and 18 ft. above the other basin floor. The sides of the triangular conduit are 20 ins. thick, reinforced with ⅞-in. diamond bars on 9-in. centers, extending from the legs to the surmounting walls and ½-in. diamond bars on 12-in. centers at both surfaces. The base of the triangle is designed as a beam with the same reinforcement as the sides. The surmounting wall is designed as a cantilever. Copper expansion joints are used in the legs and floors.

This conduit wall was built in 58½-ft. sections; the legs, the conduit floor and the sides with the surmounting wall being built at separate pourings. It being practically impossible to work the concrete in the conduit forms, two air hammers were kept constantly but gently hammering the forms during the pouring, resulting in a thoroughly compacted concrete of smooth finish. All forms and material for the dividing wall and conduit were handled by the cableway.

That portion of the inlet conduit from the main gate house to the conduit wall is a 7-ft. circular, reinforced, concrete conduit for a distance of 40 ft. to a vertical well, which forms the junction of the circular section and the triangular section of the inlet conduit.

The reinforcement of the circular conduit consisted of ½-in. rods on 6-in. centers running longitudinally, and ½-in. rods on 4-in. centers running transversely, except in the outside layer of the reinforcement in the bottom where ½-in. rods on 24-in. centers running transversely, and ½-in. rods on 4-in. centers running longitudinally, were used.

The concrete for the circular conduit was mixed in a ½-cu. yd. batch mixer, while the concrete for the vertical well was mixed in the central mixing plant, and placed by means of the cableway.

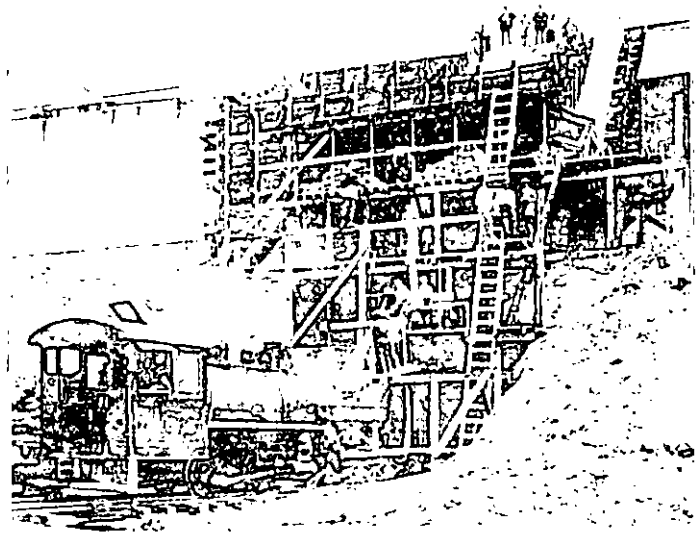

Fig. 2. View of Central Concrete Mixing Plant, North Side Reservoir Construction, Pittsburgh, Pa.

CENTRAL CONCRETE MIXING PLANT AND ITS SUPPLY AND DISTRIBUTION PLANT.

All the sand and gravel used in the construction of the reservoir was dug from the Allegheny River in the vicinity of Hoboken, from which point it was transported in barges to Millvade, where the contractor installed a hoisting plant. The material was taken from the barge in a clam shell bucket and dumped into an elevated storage bin containing compartments for coarse gravel, fine gravel and sand. From this bin it was taken to the reservoir, a distance of 1¾ miles by a group of six 5-ton auto trucks, each truck making from 18 to 20 trips per day of 11 hours. The cement was received at a siding adjacent to the Millvale storage bin, and transported to the reservoir in a 5-ton flat-bed truck. During the summer of 1914 these trucks were operated double shift, or 22 hours per day, in order to maintain a supply of materials at the reservoir site. From the fleet of seven trucks it was found necessary to hold one truck each day in the shop for overhauling.

At the reservoir the supply bins and the cement house were built on the southerly slope between the foundation of the secondary gate house and the Friday Ave. wall. These bins held approximately 400 cu. yds. of concrete gravel, 200 cu. yds. of sand and 200 cu. yds. of coarse gravel. Storage was provided for two cars of cement in the cement house and one car on the platform. Sand and gravel were dumped from the trucks directly into the bins. The cement was dumped on the Friday Ave. platform and hand handled to the chute leading to the cement house.

An electrically operated 1½ cu. yd. batch mixer was installed on the secondary gate house foundation directly in front of the storage bins. The sand and gravel from the bins were controlled by shear gates directly above the mixer hopper, while the cement was placed in a vertical chute directly over the hopper, and controlled by a slide gate. The hopper was standardized for 1 cu. yd. of concrete. During the busy season 1 cu. yd. of concrete could be turned out of the mixer every minute, although the average time of mixing was about 1½ minutes; this, of course, was for wet concrete used in walls and all flat work. The dry concrete used on slopes required about 2¼ minutes for mixing each batch.

The mixer discharged directly into shear gate buckets on flat cars, or to cradle cars. Three contractors' locomotives were required, during the time of the laying of the floor and slope blocks, to transport the concrete from the mixer to the crane. A view of the central mixing plant is shown in Fig. 2.

A stationary cableway was used in the construction of the dividing wall and conduit, and the well in the northerly embankment, also for general transportation purposes from Friday Ave., including the transporting of the steel reinforcement and concrete forms. The head tower is 50 ft. high, located on the southerly side of Friday Ave., and the tail tower is 45 ft. high, located on the gate house in the northerly embankment. The distance between towers is approximately 850 ft.

RESERVOIR LINING.

The lining of the reservoir floor and of the slopes up to the revetment consists of two 4-in. layers of concrete, the joints overlapping 8 ins. instead of the usual method of overlapping from center to center of blocks. The lining of the slopes above the revetment drain consists of a 4-in. layer of concrete covered to a depth of 12 ins. with large gravel, upon which rests a 6-in. layer of reinforced concrete, the waterproofing and a 4-in. surface layer of concrete. The floor blocks are 10 ft. square, while the blocks on the slopes vary from 8 × 10 ft. to 16 × 38 ft., the larger blocks being in the 6-in. reinforced layer.

Waterproofing of the slopes consists of

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four 1/16-in. layers of asphalt and three layers of 8-oz. saturated burlap laid alternately, between the layers of concrete, while in the floors three layers of asphalt and two layers of burlap in 18-in. strips were used at the floor joints only in such a manner that the waterproofing overlaps the joints of both layers by 5 ins. All joints were treated with asphalt either by mopping or by pouring the spaces left by the ¼-in. steel plates used as forms. The three-ply waterproofing is about ⅜-in. thick, while the two-ply waterproofing is about ¼-in. thick.

All concrete used below the revetment was mixed at the central mixing plant, transported in 1-cu. yd. batches in shear gate buckets on flat cars, lifted from the flat cars by the 70-ton crane and dumped into the forms. A few of the blocks above the revetment were placed in this same manner; a few such blocks were also built from concrete mixed in a ½ cu. yd. mixed on top of the embankment, dumping directly into the forms; but the major portion of these blocks were built from concrete mixed at the central plant, conveyed in yard cradle cars along the top of the embankment and dumped into the forms. The concrete for the floor blocks was of a wet mix, while the concrete for the slope blocks was much dryer.

On the slopes the usual system of pouring alternate blocks was followed. On the floors the concrete was laid in rows extending from one side of the basin to the opposite side, the longitudinal forms consisting of 4-in. × 6-in. stringers, while the transverse forms were ¼-in. × 4-in. steel plates set in the stringers and the points of the preceding row of blocks. The concrete was finished with straight edge and wooden trowels. In a day of 11 hours 488 cu. yds. of concrete were placed in floor blocks and finished.

The distributing conduits, which extend along the southerly slopes of both basins, were built from concrete mixed in the ½ cu. yd. mixer working along Friday Ave. A section of this conduit is in the form of a trapezoid, the top of which is horizontal, the bottom of which is the upper layer of the floor system on the 2 to 1 slope, and the sides of which are vertical. Circular openings are provided in the top of the conduit, to provide for circulation of water near the secondary gate house.

The asphalt was heated to 400° F. and applied with ordinary cotton mops. In three-ply waterproofing the burlap was lapped 13 ins., the width of burlap being 39 ins.

All concrete used in the construction of the reservoir was of 1:2:4 mix, except in negligible cases, such as manholes, catch basins and gate vaults.

The responsibility of the reservoir lies with Mr. Joseph G. Armstrong and Mr. Robert Swan, former and present directors of the Department of Public Works; Mr. Charles A. Finley, superintendent of the Bureau of Water; Mr. C. O. Daughaday and Mr. John M. Rice, Division Superintendent and Assistant Engineer, respectively, of the division of engineering in charge during the design and first four months of construction work; Mr. E. E. Lanpher and Mr. John S. Cole, Division Superintendent and Assistant Engineer, respectively, of the distribution division, in charge since November, 1912.

DISCUSSION.

The following interesting points were brought out in the discussion. Mr. J. M. Rice explained the advantage of lapping the two layers of concrete only 8 ins. instead of lapping them half their length, as is usually done, as follows:

We adopted this design from experience gained in the construction of the Pittsburgh Filtration Works. During the first season of construction the floor which was of two layers, each 4 ins. thick, was put in with the upper blocks breaking joints at the center of the lower layer blocks, and after the winter had passed we found that the upper blocks had broken just over the joints in the lower layer. In the endeavor to avoid this next season we brought out the construction used here, i. e., offsetting the vertical joints in the upper and lower layers from 6 to 8 ins., and this proved effective.

The explanation for the cause of the cracks offered is that the contraction in the lower blocks during the cold weather had been sufficient to break the upper blocks and by lapping the joints a small amount we did not get that effect, as the adhesion of the surface in contact was less than the strength of the upper layer of concrete, and thus sliding instead of cracking occurred.

In spite of the precaution taken to secure watertightness and the adoption of a waterproofing membrane, this reservoir compares very favorably in cost per million gallons with reservoirs of similar size, as shown in Table I, which gives some costs of large basins constructed in the United States.

One of the most interesting points discovered in the course of the construction work was in connection with the waterproofing. This consisted of three plies of saturated burlap mopped on with hot asphalt. Mr. S. L. Fuller discussed that feature as follows:

The specifications said "all surfaces receiving waterproofing shall be clean, dry and smooth." The word "dry" in relation to setting concrete was subject to the decision of the inspectors and naturally was an open point for argument, as in order to keep the work moving we desired to lay the waterproofing as soon as possible, while the inspectors held out for strictly dry surfaces. We had occasion to remove one of the top blocks and much to our surprise and gratification we found that while the layer of waterproofing which had been mopped on to the 24-hour old concrete had no adhesion to it at all, yet the top block which had been poured wet on to the asphalt could not be separated from it. We then made several experiments and we found that the best bond between the asphalt and concrete was obtained when the asphalt was mopped on as soon as the concrete had set, so that it could be walked on without injury. The theory we advance is that as soon as concrete starts to set it starts to "dust," and by applying the asphalt practically before this starts we avoid the thin layer of dust, which it is impossible to remove and which prevents the close adhesion of asphalt to concrete.

Probably the most remarkable thing about the job was the speed obtained in laying the 4-in. floor slabs. Through a carefully designed concrete plant with one Ransome 40 cu. ft. mixer, motor driven, we were able to average 375 cu. yds. per day for a period of four weeks, the maximum day's output being 489 cu. yds. All of the material for this was hauled by five, 5-ton Pierce Arrow motor trucks, which we found most economical in operation. These we worked 24 hours a day and they hauled over a distance of 1¾ miles, the last ¾ mile being all up a 4 to 6 per cent grade. The economy of the motor truck was marked. We cut down the haul by probably half over what we could have accomplished with teams, and it would have been impossible to complete the reservoir in one season had it not been for the truck proposition, because we could not have worked 150 teams in and out. As it was, with the team making six trips a day from the hoist to the job, we had to snap them all up the hill. We put on three teams and had four teams to bring up the three wagons. That was before we procured the trucks. Of course the upkeep of trucks is heavy on that hill, but there is no question that the truck proposition was the life saver of the job.

TABLE I.—COST OF SIX LARGE AMERICAN WATER WORKS RESERVOIRS.

Reservoir.	Location.	Capacity in million gals.	Cost.	Cost per million gals.
Queen Lane	Philadelphia, Pa.	383	$1,188,000	$3,100
New Roxborough	Philadelphia, Pa.	147	524,000	3,600
Settling Basins	Cincinnati, Ohio	330	1,276,000	3,900
Service Reservoir	Minneapolis, Minn.	93	442,000	4,750
Prospect	Rochester, N. Y.	110	554,000	5,000
Northside	Pittsburgh, Pa.	150	676,000	4,100

Time Studies in Connection With the Cleaning of Filter Sand at Philadelphia.

Efficiency in municipal government will only come about as the work in the various departments is put on a basis which gives each man, from the common laborer up to the skilled artisan and clerk, a well-defined task to do in a given time, with a definite reward for its accomplishment. Under the ordinary methods of handling city work it is cheaper where there is fair competition to let work by contract than to handle it by day labor. With an effective system that eliminates not merely favoritism but also presents a definite incentive for each man to do a fair day's work, the day labor plan becomes more attractive from an economic standpoint. The construction and maintenance work in the department of public works is a field that offers the largest opportunities from an engineering standpoint. It includes such operations as trenching, pipe-laying, sewer construction, aqueduct construction, filter cleaning, street cleaning, road building, grading, concrete work and building construction. Under ordinary municipal management it is out of the question, as above indicated, to handle work of this kind economically. However, practically every one of the classes of work mentioned has been handled at large reduction of cost by means of systematic planning of the work in advance and layout of tasks or establishment of piece rates.

The present article describes one accomplishment of Philadelphia along the line of improved methods. The particular operation studied is the cleaning of filter sand. Our information is from a paper before the American Society of Mechanical Engineers by Mr. Sanford E. Thompson.

Philadelphia has five large filtration plants consisting of covered reservoirs operated by slow sand filtration. The water pumped into the reservoir from the Schuylkill and the Delaware Rivers, after passing through the pre-filters, percolates through about 4 ft. of sand and gravel and is thus purified. The impurities are caught largely in the upper few inches of sand, so that if this upper portion is washed the filtration area is practically renewed. Several methods of cleaning filter sands are in use, all of them involving considerable manual labor. Further details of the methods followed in the case under observation are referred to below.

RESULTS.

The object of the plan has been to lay out the work of each gang of men so as to increase the effectiveness of the plant and provide a definite task to be accomplished in a day. The results of the plan which is being put into operation are as follows:

Rotation of cleaning the filters is planned in advance by well-defined rule.

A definite area of sand to clean is assigned to each gang, this area depending upon the depth of cleaning necessary.

This setting of tasks has increased output of each gang 15 per cent and this should be further increased to at least 25 per cent.

Accurate records are kept, showing the time consumed by each gang.

Cost accounts, as well as pay-roll, are made up from the time tickets furnished to the men.

Gang leaders are required to pay closer attention to their duties.

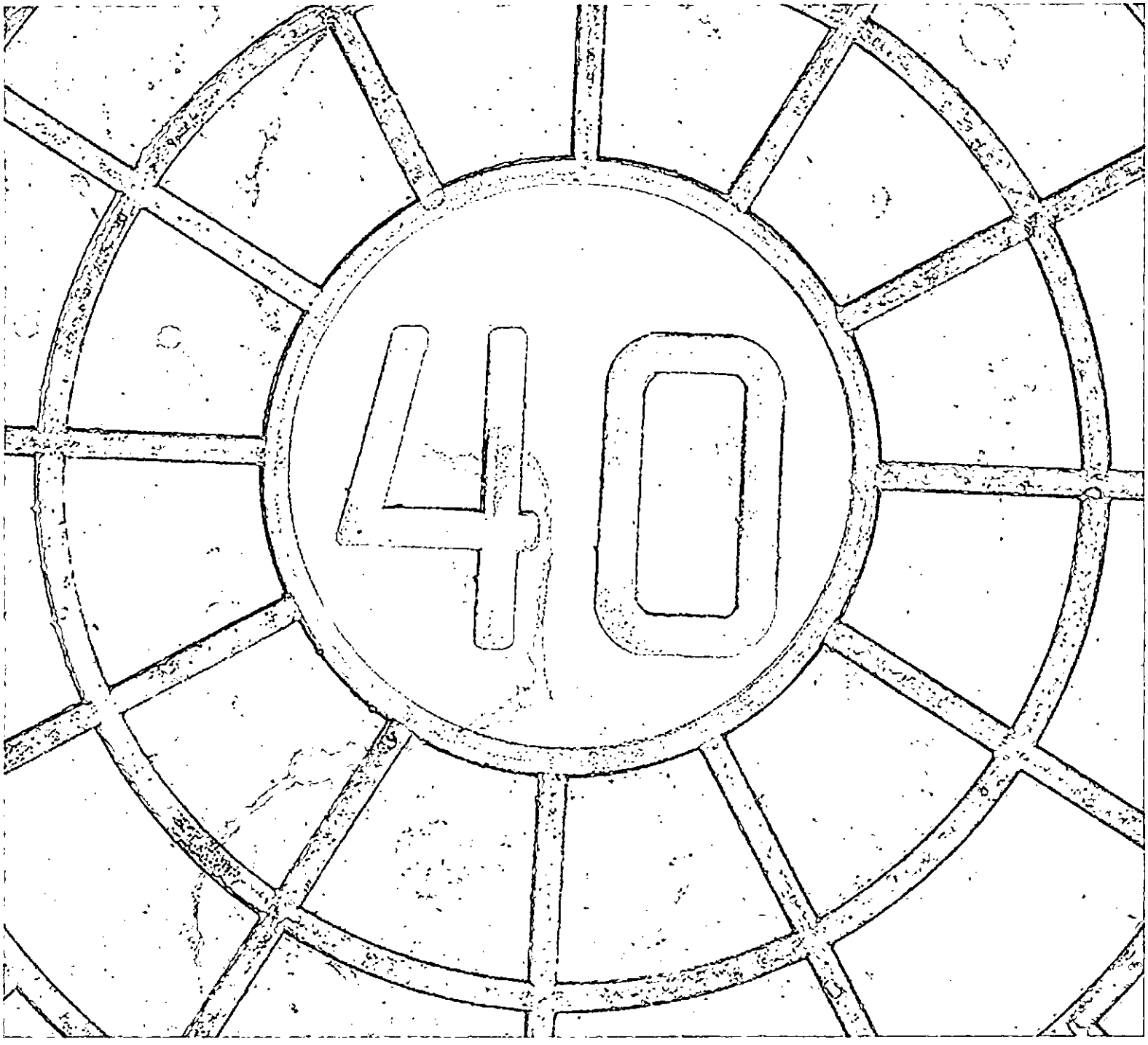
Improved apparatus and machinery are under consideration.

Methods of determining depths of sand to clean are being standardized.

OBSTACLES.

The greatest obstacle encountered has been the city ordinance fixing the rate of pay of unskilled laborers on a level wage per day

APPENDIX 3-4



APPENDIX 3-4
WATER DISTRIBUTION SYSTEM COST ESTIMATE INFORMATION

PWSA 40-Year Plan
Estimated Costs for Waterline Excavation, Backfill, and Paving
From RS Means Heavy Construction Cost Data 2011

Excavation - assumes no slope for trench walls

Depth of cover over pipe (C) =	48	inches =	4.00	feet
Trench width on each side of pipe =	12	inches =	1.00	feet
Trench depth below bottom of pipe =	6	inches =	0.50	feet

Pipe Diameter (inches)	Pipe Diameter (feet)	Pipe Area (sq. ft.)	Trench Width "W" (feet)	Trench Depth "D" (feet)	Excav. Trench Volume (Cu. Ft.)	Excav. Cost per LF @ $0.52 per Cu. Ft.
1	0.08	0.01	1.00	4.58	4.58	2.40
1.5	0.13	0.01	1.00	4.63	4.63	2.42
2	0.17	0.02	1.00	4.67	4.67	2.44
3	0.25	0.05	1.00	4.75	4.75	2.49
4	0.33	0.09	2.33	4.83	11.28	5.91
6	0.50	0.20	2.50	5.00	12.50	6.55
8	0.67	0.35	2.67	5.17	13.78	7.22
10	0.83	0.55	2.83	5.33	15.11	7.91
12	1.00	0.79	3.00	5.50	16.50	8.64
14	1.17	1.07	3.17	5.67	17.94	9.40
15	1.25	1.23	3.25	5.75	18.69	9.79
16	1.33	1.40	3.33	5.83	19.44	10.18
18	1.50	1.77	3.50	6.00	21.00	11.00
20	1.67	2.18	3.67	6.17	22.61	11.84
24	2.00	3.14	4.00	6.50	26.00	13.62
30	2.50	4.91	4.50	7.00	31.50	16.50
36	3.00	7.07	5.00	7.50	37.50	19.64
42	3.50	9.62	5.50	8.00	44.00	23.05
48	4.00	12.57	6.00	8.50	51.00	26.71
50	4.17	13.64	6.17	8.67	53.44	27.99
60	5.00	19.63	7.00	9.50	66.50	34.83
66	5.50	23.76	7.50	10.00	75.00	39.28
72	6.00	28.27	8.00	10.50	84.00	44.00
84	7.00	38.48	9.00	11.50	103.50	54.21
90	7.50	44.18	9.50	12.00	114.00	59.71
96	8.00	50.27	10.00	12.50	125.00	65.47
120	10.00	78.54	12.00	14.50	174.00	91.13

PWSA 40-Year Plan
Estimated Costs for Waterline Excavation, Backfill, and Paving
From RS Means Heavy Construction Cost Data 2011

Backfill - assumes $40.00 per cubic yard cost for trench backfill material

Depth of cover over pipe (C) =	42	inches =	3.50 feet
Trench width on each side of pipe =	12	inches =	1.00 feet
Trench depth below bottom of pipe =	6	inches =	0.50 feet

Pipe Diameter (inches)	Pipe Diameter (feet)	Pipe Area (sq. ft.)	Trench Width "W" (feet)	Trench Depth "D" (feet)	Backfill Trench Volume (Cu. Ft.)	Backfill Cost per LF @ $1.48 per Cu. Ft.
1	0.08	0.01	1.00	4.08	4.08	6.04
1.5	0.13	0.01	1.00	4.13	4.11	6.09
2	0.17	0.02	1.00	4.17	4.14	6.14
3	0.25	0.05	1.00	4.25	4.20	6.22
4	0.33	0.09	2.33	4.33	10.02	14.85
6	0.50	0.20	2.50	4.50	11.05	16.38
8	0.67	0.35	2.67	4.67	12.10	17.92
10	0.83	0.55	2.83	4.83	13.15	19.48
12	1.00	0.79	3.00	5.00	14.21	21.06
14	1.17	1.07	3.17	5.17	15.29	22.65
15	1.25	1.23	3.25	5.25	15.84	23.46
16	1.33	1.40	3.33	5.33	16.38	24.27
18	1.50	1.77	3.50	5.50	17.48	25.90
20	1.67	2.18	3.67	5.67	18.60	27.55
24	2.00	3.14	4.00	6.00	20.86	30.90
30	2.50	4.91	4.50	6.50	24.34	36.06
36	3.00	7.07	5.00	7.00	27.93	41.38
42	3.50	9.62	5.50	7.50	31.63	46.86
48	4.00	12.57	6.00	8.00	35.43	52.49
50	4.17	13.64	6.17	8.17	36.73	54.41
60	5.00	19.63	7.00	9.00	43.37	64.24
66	5.50	23.76	7.50	9.50	47.49	70.36
72	6.00	28.27	8.00	10.00	51.73	76.63
84	7.00	38.48	9.00	11.00	60.52	89.65
90	7.50	44.18	9.50	11.50	65.07	96.40
96	8.00	50.27	10.00	12.00	69.73	103.31
120	10.00	78.54	12.00	14.00	89.46	132.53

PWSA 40-Year Plan
Estimated Costs for Waterline Excavation, Backfill, and Paving
From RS Means Heavy Construction Cost Data 2011

$125 per ton for asphalt paving
680 pounds of asphalt per square yard
42.5 per sqare yard

Paving - assumes $42.50 per square yard cost for 6 inch thick asphalt paving

Trench width on each side of pipe = 12 inches = 1.00 feet

Pipe Diameter (inches)	Pipe Diameter (feet)	Pipe Area (sq. ft.)	Paving Area (sq. ft.)	Paving Cost per LF @ $4.72 per sq. ft.
1	0.08	0.01	1.00	4.72
1.5	0.13	0.01	1.00	4.72
2	0.17	0.02	1.00	4.72
3	0.25	0.05	1.00	4.72
4	0.33	0.09	2.33	11.02
6	0.50	0.20	2.50	11.81
8	0.67	0.35	2.67	12.59
10	0.83	0.55	2.83	13.38
12	1.00	0.79	3.00	14.17
14	1.17	1.07	3.17	14.95
15	1.25	1.23	3.25	15.35
16	1.33	1.40	3.33	15.74
18	1.50	1.77	3.50	16.53
20	1.67	2.18	3.67	17.31
24	2.00	3.14	4.00	18.89
30	2.50	4.91	4.50	21.25
36	3.00	7.07	5.00	23.61
42	3.50	9.62	5.50	25.97
48	4.00	12.57	6.00	28.33
50	4.17	13.64	6.17	29.12
60	5.00	19.63	7.00	33.06
66	5.50	23.76	7.50	35.42
72	6.00	28.27	8.00	37.78
84	7.00	38.48	9.00	42.50
90	7.50	44.18	9.50	44.86
96	8.00	50.27	10.00	47.22
120	10.00	78.54	12.00	56.67

Pipe Installation Costs
From RS Means Heavy Construction Cost Data 2011
Mechanical Joint Class 50 DI pipe

Pipe Diameter (inches)	Material	Labor	Equipment	Total	Total Incl. O&P	O&P Multiplier
4	12.50	8.55	2.17	23.22	29.00	1.25
6	14.60	10.70	2.72	28.02	35.00	1.25
8	21.00	12.80	3.26	37.06	46.00	1.24
10	26.50	14.95	3.80	45.25	55.50	1.23
12	32.00	16.25	4.13	52.38	64.00	1.22
14	48.50	17.10	4.34	69.94	84.50	1.21
16	50.00	23.50	5.95	79.45	97.00	1.22
18	53.00	25.00	6.30	84.30	103.00	1.22
20	56.00	30.00	7.60	93.60	115.00	1.23
24	61.00	36.50	9.25	106.75	132.00	1.24
						1.23 ave. multiplier

Calculated Values for Ductile Iron Pipe Based on Best Fit Lines
Excluding Excavation, Backfill, Paving

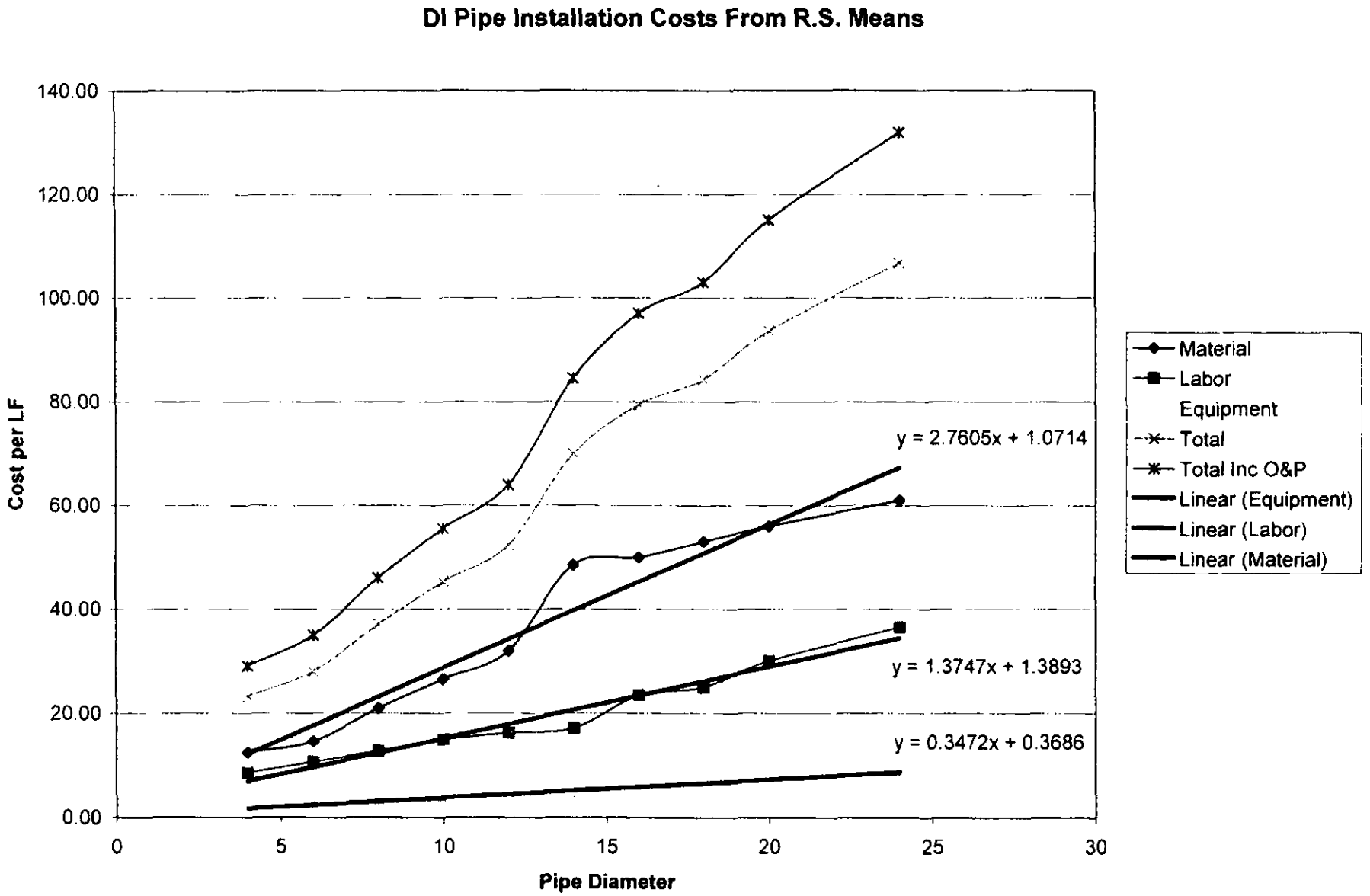
Pipe Diameter (feet)	Material	Labor	Equipment	Total	Total Incl. O&P
4	12.11	6.89	1.76	20.76	25.54
6	17.63	9.64	2.45	29.72	36.57
8	23.16	12.39	3.15	38.69	47.60
10	28.68	15.14	3.84	47.65	58.63
12	34.20	17.89	4.54	56.62	69.66
14	39.72	20.64	5.23	65.58	80.69
15	42.48	22.01	5.58	70.07	86.21
16	45.24	23.38	5.92	74.55	91.72
18	50.76	26.13	6.62	83.51	102.75
20	56.28	28.88	7.31	92.48	113.78
24	67.32	34.38	8.70	110.41	135.84
30	83.89	42.63	10.78	137.30	168.93
36	100.45	50.88	12.87	164.20	202.02
42	117.01	59.13	14.95	191.09	235.11
48	133.58	67.37	17.03	217.98	268.20
50	139.10	70.12	17.73	226.95	279.23
60	166.70	83.87	21.20	271.77	334.38

Costs for Copper Pipe, Type K
Excluding Excavation, Backfill, Paving

Pipe Diameter (feet)	Material	Labor	Equipment	Total	Total Incl. O&P
1					14.65
1.5					22.50
2					32.50
3					65.00

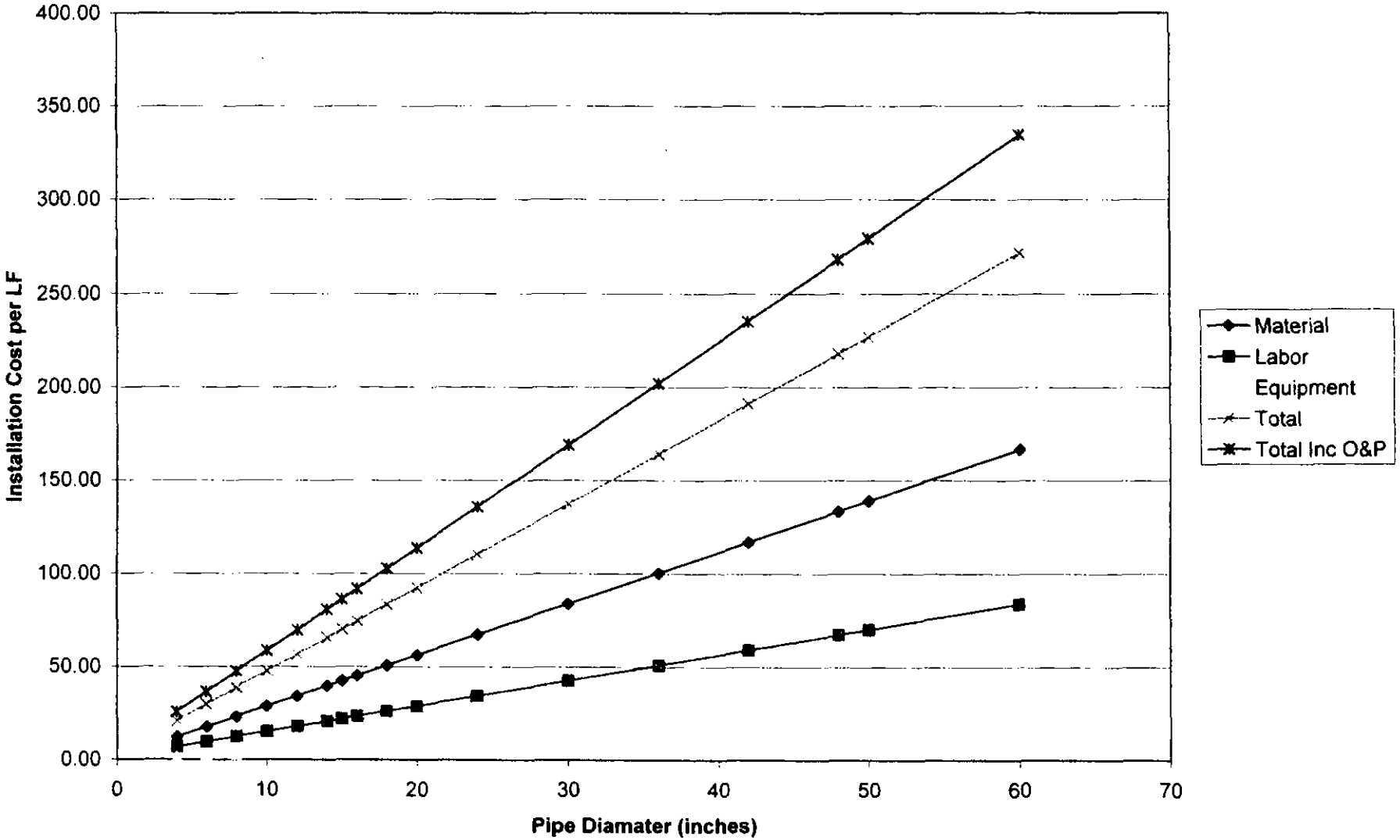
Costs for Prestressed Concrete Cylinder Pipe (PCCP)
Excluding Excavation, Backfill, Paving

Pipe Diameter (feet)	Material	Labor	Equipment	Total	Total Incl. O&P
66					450.00
72					495.00
84					660.00
90					800.00
96					940.00
120					1,950.00



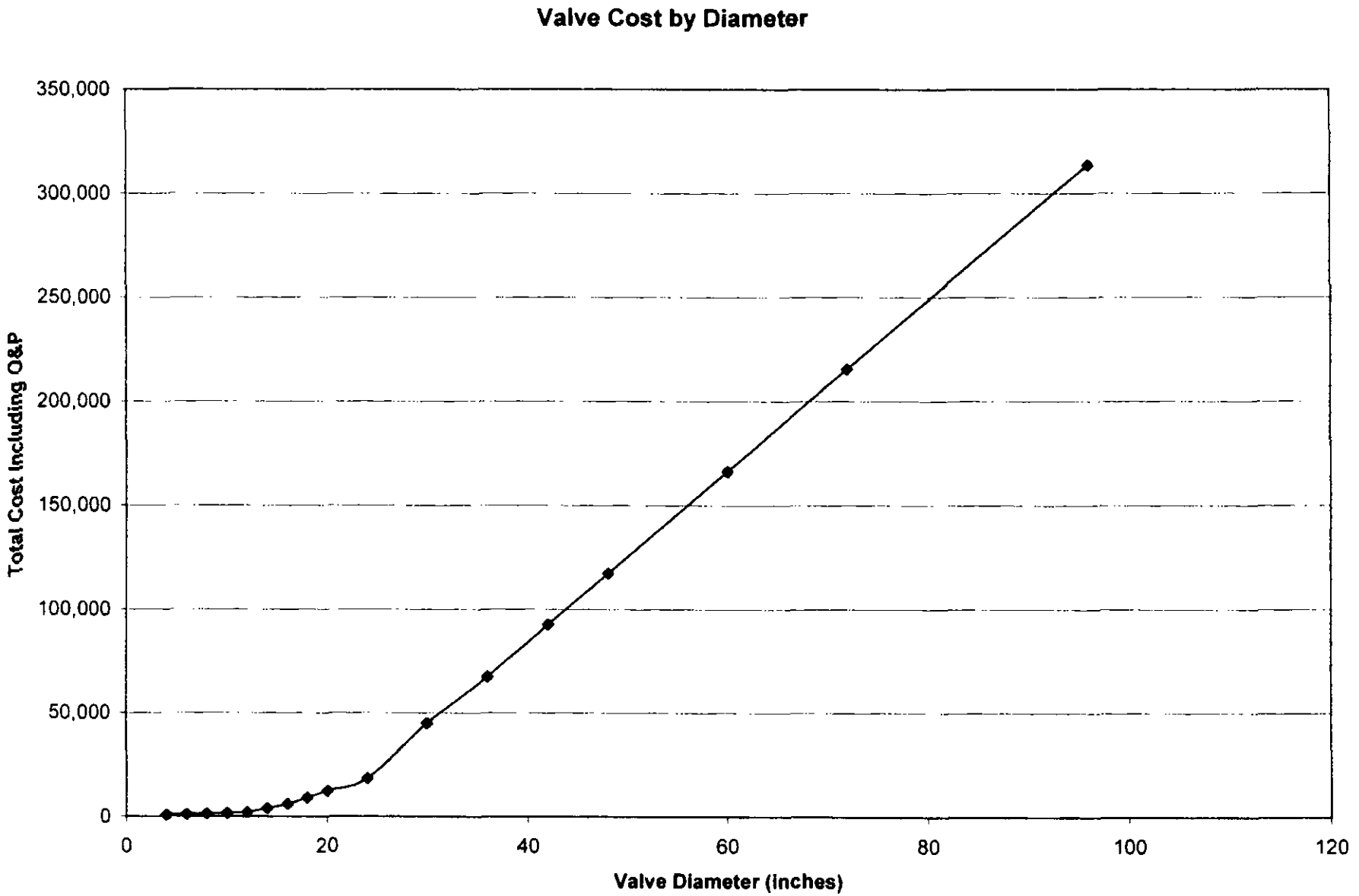
OSBA-I-4 Attach A

DI Pipe Installation Costs Based on Best Fit Lines

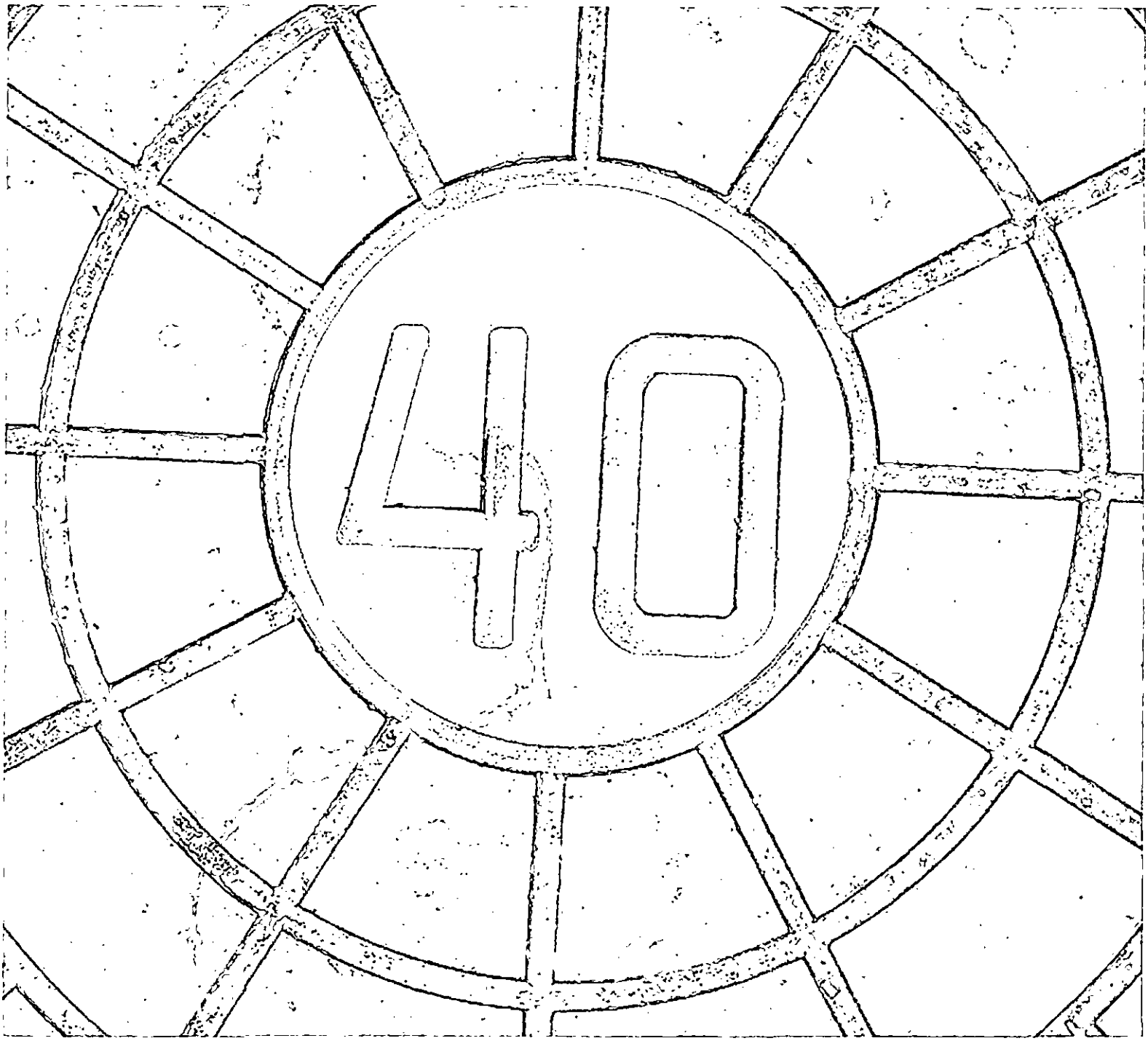


Total Estimated Cost for Water Piping Installation per LF

Pipe Diameter (inches)	Excavation	Backfill	Paving	Pipe Material	Piping Subtotal	Allowance for Fittings 10.00% percent	Rounded Cost per LF
1	2.40	6.04	4.72	14.65	27.81	2.78	31.00
1.5	2.42	6.09	4.72	22.50	35.74	3.57	39.00
2	2.44	6.14	4.72	32.50	45.81	4.58	50.00
3	2.49	6.22	4.72	65.00	78.43	7.84	86.00
4	5.91	14.85	11.02	25.54	57.32	5.73	63.00
6	6.55	16.38	11.81	36.57	71.30	7.13	78.00
8	7.22	17.92	12.59	47.60	85.33	8.53	94.00
10	7.91	19.48	13.38	58.63	99.41	9.94	109.00
12	8.64	21.06	14.17	69.66	113.53	11.35	125.00
14	9.40	22.65	14.95	80.69	127.70	12.77	140.00
15	9.79	23.46	15.35	86.21	134.80	13.48	148.00
16	10.18	24.27	15.74	91.72	141.91	14.19	156.00
18	11.00	25.90	16.53	102.75	156.18	15.62	172.00
20	11.84	27.55	17.31	113.78	170.49	17.05	188.00
24	13.62	30.90	18.89	135.84	199.25	19.92	219.00
30	16.50	36.06	21.25	168.93	242.74	24.27	267.00
36	19.64	41.38	23.61	202.02	286.65	28.67	315.00
42	23.05	46.86	25.97	235.11	330.99	33.10	364.00
48	26.71	52.49	28.33	268.20	375.74	37.57	413.00
50	27.99	54.41	29.12	279.23	390.75	39.08	430.00
60	34.83	64.24	33.06	334.38	466.51	46.65	513.00
66	39.28	70.36	35.42	450.00	595.06	59.51	655.00
72	44.00	76.63	37.78	495.00	653.40	65.34	719.00
84	54.21	89.65	42.50	660.00	846.36	84.64	931.00
90	59.71	96.40	44.86	800.00	1,000.97	100.10	1,101.00
96	65.47	103.31	47.22	940.00	1,156.00	115.60	1,272.00
120	91.13	132.53	56.67	1,950.00	2,230.33	223.03	2,453.00


Valve Cost by Diameter
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Total Cost Including O&P
0
20
40
60
80
100
120
Valve Diameter (inches)

APPENDIX 3-5



APPENDIX 3-5
TREATMENT, PUMPING, AND STORAGE COST ESTIMATE INFORMATION

Highland Membrane Filtration Plant
Cost for Original Facility Based on PWSA Records

Cost in 2002	8,573,257
2002 ENR CCI Index	6468.01
April 2011 ENR CCI Index	9027.23
Trended Cost for Original Plant	11,965,467
Est. Exp. Cost from 20 to 26 mgd	3,825,500
Total Est. Replacement Cost	15,790,967
Rounded Replacement Cost	15,791,000

Nashville, TN - 30 mgd expansion - clarifiers, filters, and chemical feed

Capacity Expansion (mgd)	30
1991 Construction Cost	$18,600,000
ENR CCI in 1991	4835.20
ENR CCI in April 2011	9027.23
Trended Cost for 30 mgd Capacity	$34,725,860
PWSA WTP Capacity (mgd)	117
Estimated Cost for PWSA	131,062,117
Rounded Cost	131,100,000

Estimated Costs for In-Ground Reservoirs

Lanpher Reservoir Contract Price	681,976
ENR CCI in 1912	90.7
ENR CCI in April 2011	9027.23
Trended Cost for Lanpher	67,876,000

Highland No. 2 Floating Cover Price

Bid Price for Cover	1,346,750
ENR CCI in Sept. 2009	8578.71
ENR CCI in April 2011	9027.23
Trended Cost for Lanpher	1,417,000

Reservoir	Capacity (MG)	Estimated Reservoir Cost	Surface Area (sq. ft.)	Estimated Cover Cost	Total Est. Replacement Cost
Herron Hill	12.8	6,024,000	96,000	209,000	6,233,000
Highland No. 1	130.5	62,594,000	918,000	NO COVER	62,594,000
Highland No. 2	125.0	63,793,000	651,000	1,417,000	65,210,000
Lanpher	133.0	67,876,000	584,000	1,271,000	69,147,000
Sed. Basins.	73.0	37,255,000			

Estimated Cost for Clearwell
From December 2008 Report by Malcolm Pirnie, Inc. "Clearwell Improvements Phase 1 - Study"

December 2008 Cost	52,817,000
ENR CCI in December 2008	8551.32
ENR CCI in April 2011	9027.23
Trended Cost	55,756,000

Estimated Cost for Raw Water Intakes

2010 - Traveling Water Screens	1,183,339
Est. Cost for Intake Structure	2,320,000
Total Estimated Cost	3,500,000

PWSA 40-Year Capital Plan - Estimated Pump Station Replacement Costs

Pump Station	Building Area (sq. ft.)	Building Cost @ $350 per Sq. ft.	Mechanical & Piping	Subtotal Building, Mechanical, & Piping	General Req, Site Work, Electrical	Total Estimated Construction Cost
Ross	31,175	10,911,000	4,171,000	15,082,000	3,771,000	18,853,000
Aspinwall	23,125	8,094,000	3,225,000	11,319,000	2,830,000	14,149,000
Bruecken (1)	7,920	2,772,000	6,609,000	9,381,000	2,345,000	11,726,000
Herron Hill	6,984	2,444,000	1,234,000	3,678,000	920,000	4,598,000
Highland	2,470	865,000	331,000	1,196,000	299,000	1,495,000
Howard	12,325	4,314,000	2,120,000	6,434,000	1,609,000	8,043,000
Lincoln	1,984	694,000	271,000	965,000	241,000	1,206,000
Mission	9,800	3,430,000	1,871,000	5,301,000	1,325,000	6,626,000
Saline	1,560	546,000	808,000	1,354,000	339,000	1,693,000
Herron Hill Tank (2)			77,000			
Inline (3)			73,000			
Millvale (4)			103,000			

(1) Pumps for Fox Chapel PS are located inside Bruecken PS
(2) Pumps are located in the base of the Herron Hill tank
(3) Packaged station buried in the street

OSBA-I-4 Attach A

PWSA 40-Year Capital Plan
Estimated 2011 Costs for Steel Water Storage Tanks

Tank	Diameter (feet)	Height (feet)	H / D	Capacity (MG)	Estimated Tank Cost	Estimated Foundation Concrete (CY)	Foundation Cost @ $600 per CY	Total Estimated Construction Cost
Allentown 1	100	50	0.50	2.94	1,416,443	151	90,792	1,510,000
Allentown 2	100	50	0.50	2.94	1,416,443	151	90,792	1,510,000
Bedford	120	25	0.21	2.11	1,062,453	216	129,887	1,190,000
Brashear 1	195	25	0.13	5.58	2,555,850	564	338,672	2,890,000
Brashear 2	195	25	0.13	5.58	2,555,850	564	338,672	2,890,000
Lincoln	93	62	0.67	3.15	1,508,071	131	78,758	1,590,000
Spring Hill 1	50	34	0.68	0.50	367,115	39	23,597	390,000
Spring Hill 2	50	34	0.68	0.50	367,115	39	23,597	390,000
Squirrel Hill	80	82	1.03	3.08	1,479,150	98	58,678	1,540,000

RS Means Heavy Construction Cost Data 2011 - Water Storage Tanks
Steel, Ground Level, Not Including Foundation

Tank Capacity (gallons)	Cost
100,000	196,000
250,000	260,000
500,000	368,000
750,000	475,000
1,000,000	583,000
2,000,000	1,013,000
4,000,000	1,873,000
6,000,000	2,733,000
8,000,000	3,593,000
10,000,000	4,460,000

$y = 0.4304 x + 152,192$

OSBA-I-4 Attach A

PWSA 40-Year Capital Plan
Estimated 2011 Costs for Elevated Steel Water Storage Tanks

Tank	Floor Elevation (feet)	Ground Elevation (feet)	Height to Bottom Capacity (feet)	Tank Capacity (MG)	Estimated Tank Cost	Estimated Foundation Concrete (CY)	Foundation Cost @ $600 per CY	Total Estimated Construction Cost
Herron Hill (existing)	1,322	1,220	102	0.40	1,237,600	196	117,600	1,360,000
Garfield (existing)	1,275	1,180	95	2.00	5,190,000	1,100	660,000	5,850,000

RS Means Heavy Construction Cost Data 2011 - Elevated Water Storage Tanks
Not Including Pipe, Pumps, or Foundation
Elevated Water Tanks, 100' to Bottom Capacity Line, Includes Painting

Tank Capacity (gallons)	Cost		
50,000	200,000		
100,000	300,000		
250,000	844,000		
500,000	1,500,000	400,000	1,237,600
750,000	1,820,000		
1,000,000	2,600,000		
1,400,000	3,650,000		
2,000,000	5,190,000		
2,200,000	5,740,000		
2,300,000	6,000,000		
2,500,000	6,500,000		

OSBA-I-4 Attach A

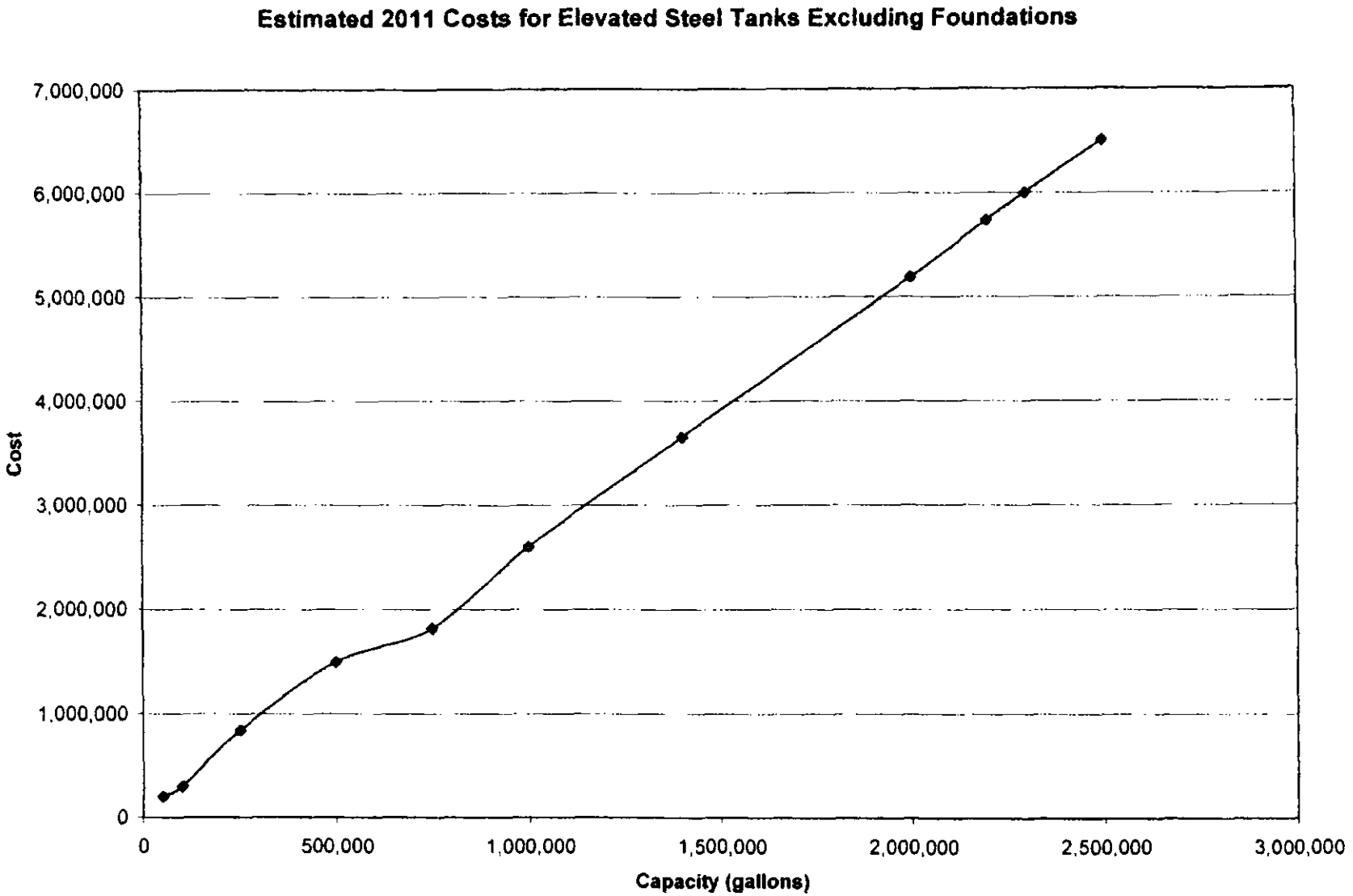
PWSA 40-Year Capital Plan
Estimated 2011 Costs for Concrete Water Storage Tanks

Tank	Diameter (feet)	Height (feet)	Capacity (MG)	Estimated Tank Cost	Estimated Foundation Concrete (CY)	Foundation Cost @ $600 per CY	Total Estimated Construction Cost
McNaugher 1	185	25	5.00	1,976,000	509	305,162	2,280,000
McNaugher 2	50	25	0.40	375,000	39	23,597	400,000

RS Means Heavy Construction Cost Data 2011 - Water Storage Tanks
Prestressed Concrete Above Ground Water Utility Storage Tanks
Not Including Foundation, Piping, or Pumps

Tank Capacity (gallons)	Cost		
250,000	297,000		
500,000	485,000	400,000	375,000
1,000,000	703,000		
2,000,000	1,067,000		
4,000,000	1,697,000		
6,000,000	2,255,000	5,000,000	1,976,000
8,000,000	2,909,000		
10,000,000	3,519,000		

OSBA-I-4 Attach A



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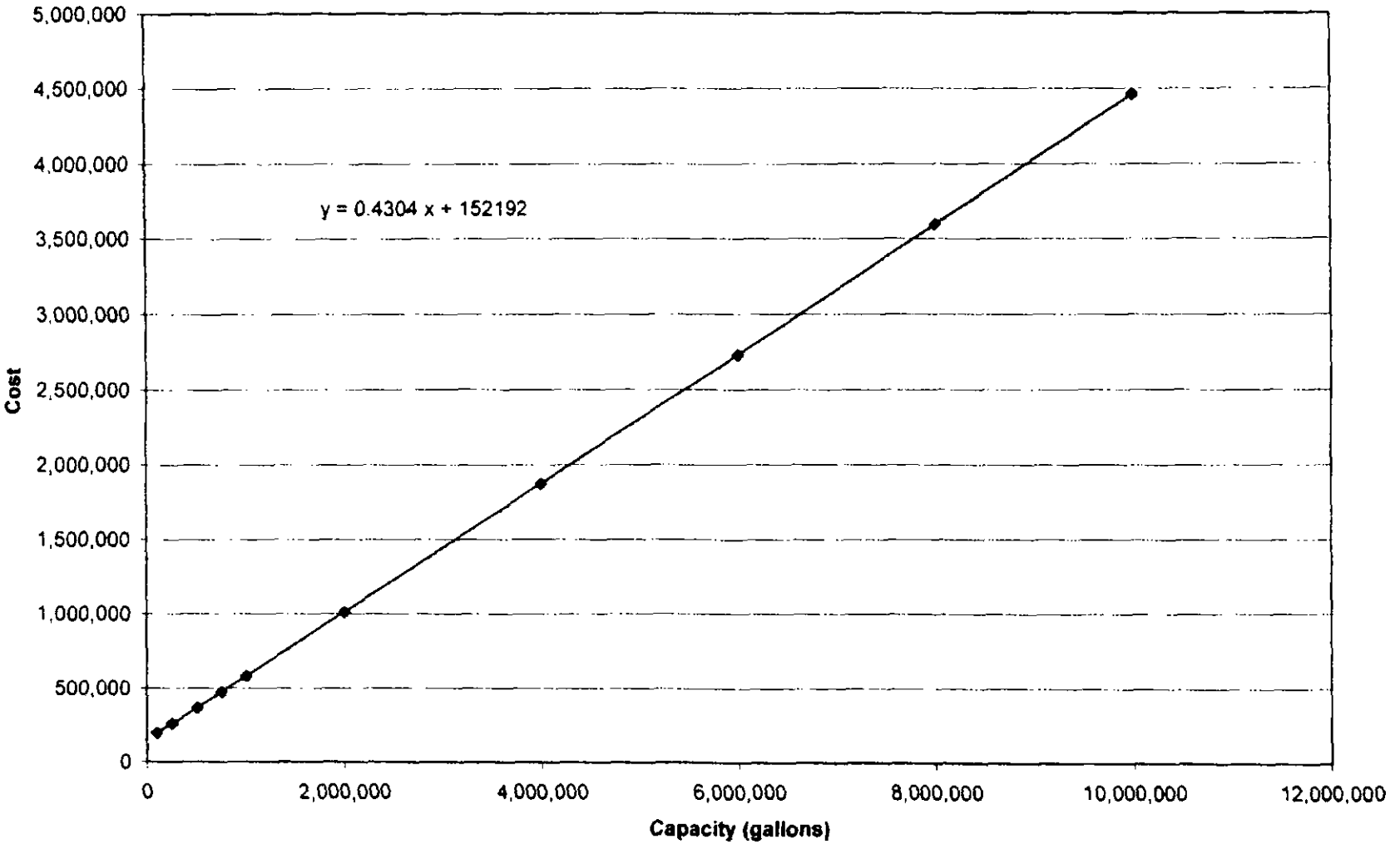

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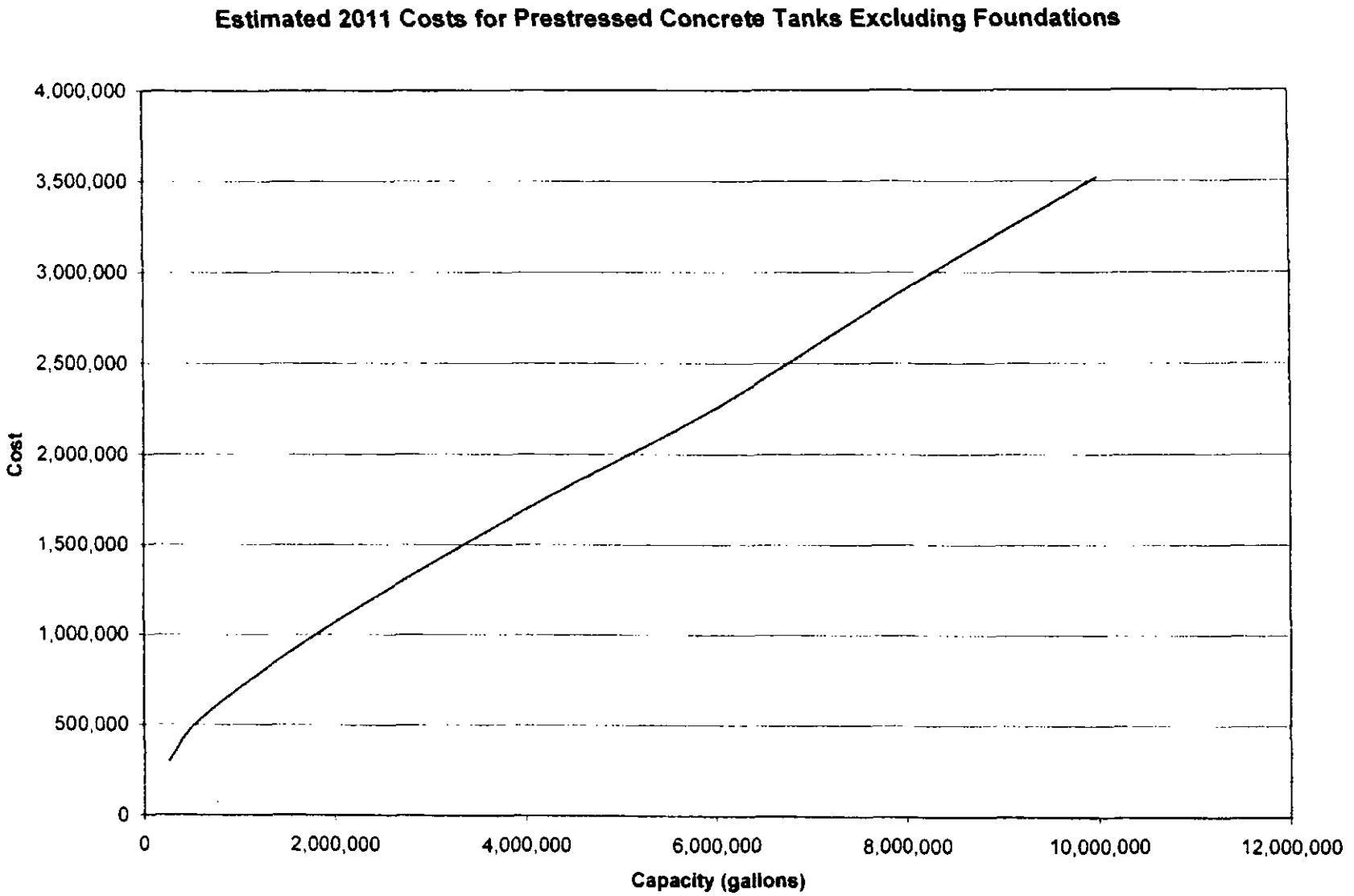

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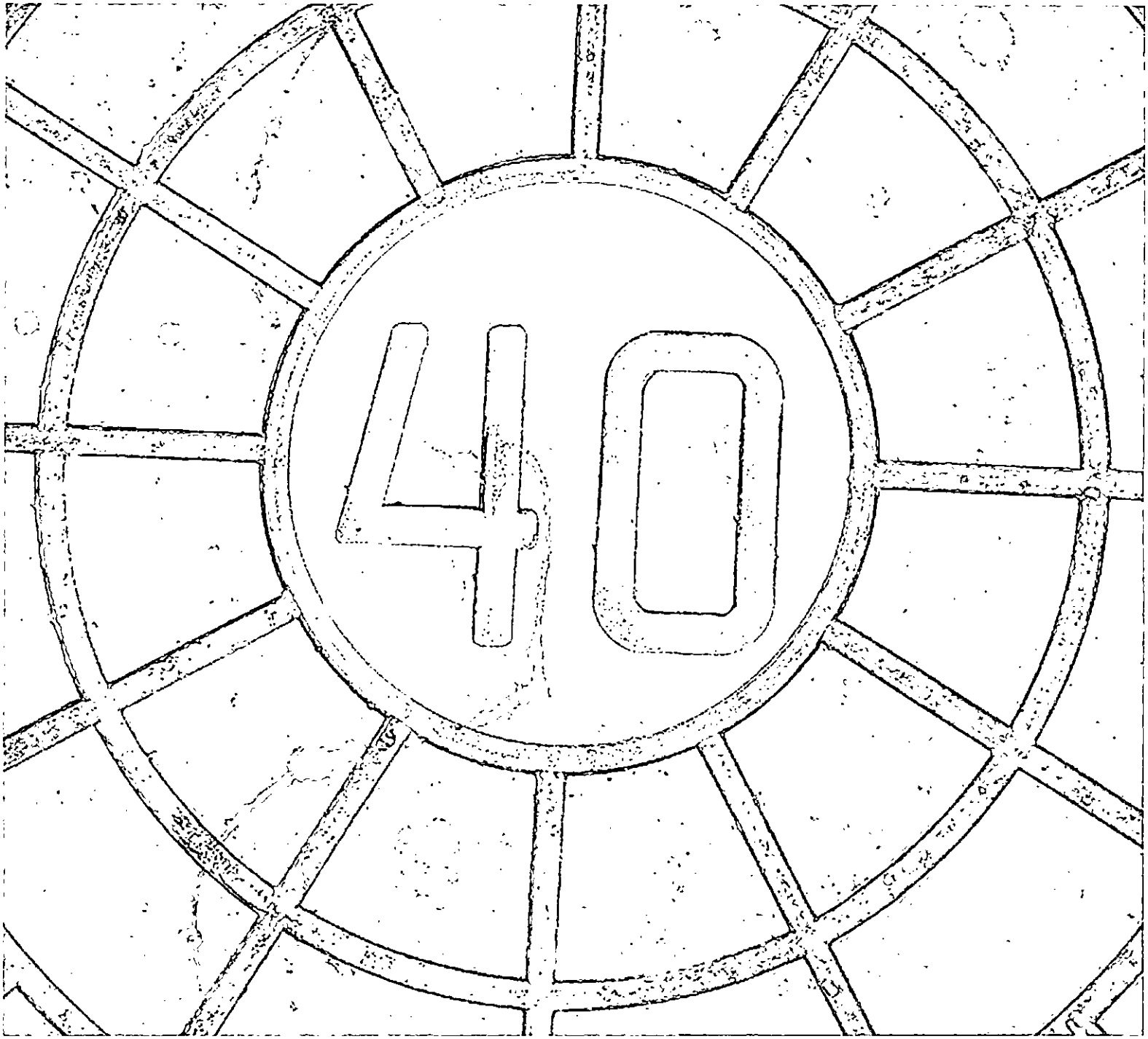
APPENDIX 3-6

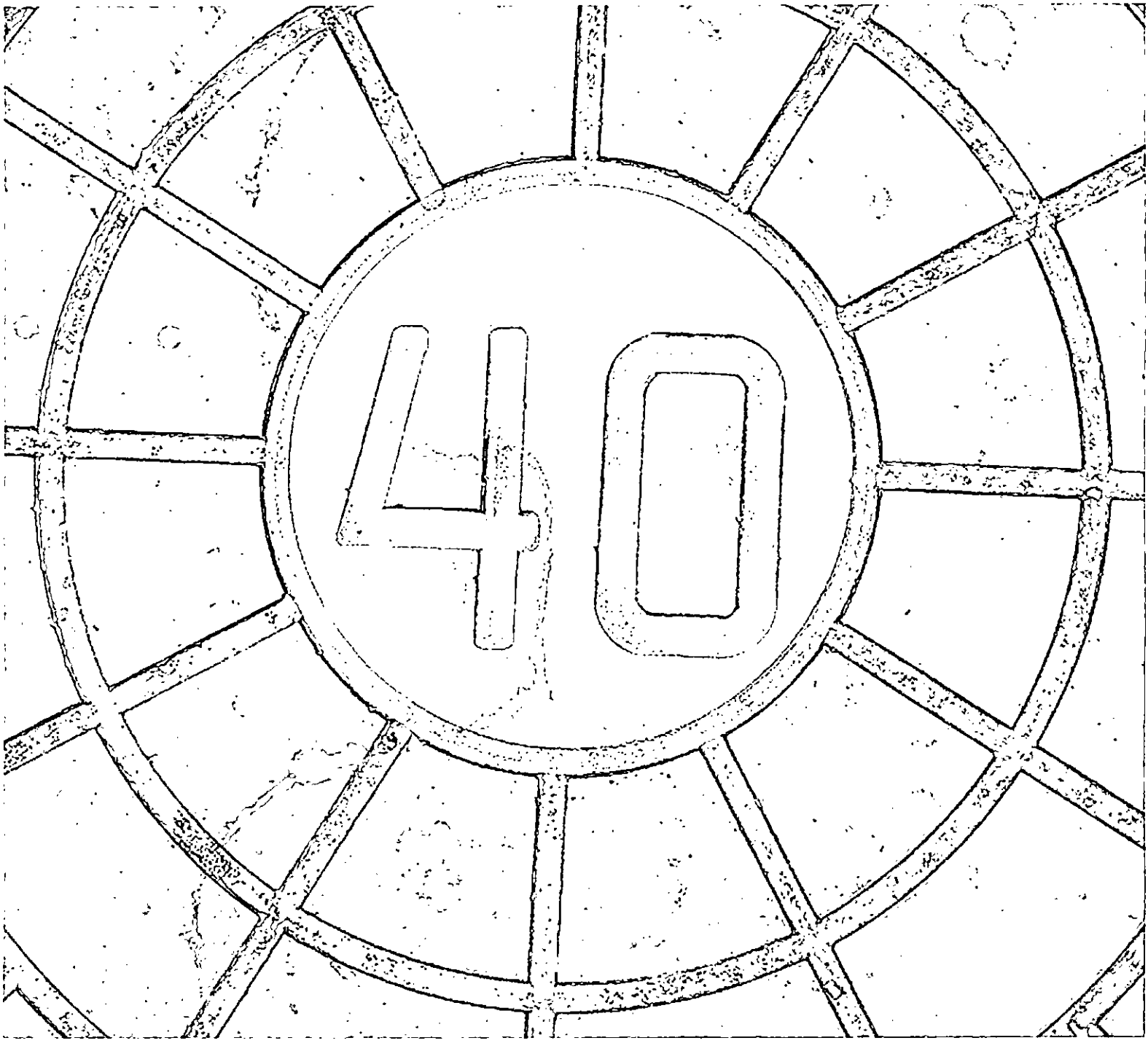


APPENDIX 3-6
SEWER SYSTEM COST ESTIMATE INFORMATION

Total Estimated Cost for Sewer Piping Installation per LF

Pipe Diameter (inches)	Excavation	Backfill	Paving	Pipe Material	Piping Subtotal	Allowance for Fittings 2.00% percent	Rounded Cost per LF	Pipe Material
4	11.49	37.32	7.43	5.80	62.04	1.24	63	PVC
6	12.50	40.45	11.81	8.10	72.85	1.46	74	PVC
8	13.53	43.60	12.59	12.55	82.27	1.65	84	PVC
10	14.59	46.76	13.38	18.00	92.74	1.85	95	PVC
12	15.68	49.95	14.17	20.00	99.79	2.00	102	PVC
15	17.36	54.76	15.35	23.50	110.96	2.22	113	PVC
18	19.09	59.60	16.53	26.00	121.22	2.42	124	PVC
21	20.88	64.49	17.71	33.00	136.08	2.72	139	PVC
24	22.72	69.42	18.89	40.50	151.53	3.03	155	PVC
27	24.63	74.39	20.07	87.50	206.58	4.13	211	RCP
30	26.59	79.39	21.25	98.50	225.73	4.51	230	RCP
33	28.60	84.44	22.43	108.75	244.23	4.88	249	RCP
36	30.68	89.53	23.61	119.00	262.82	5.26	268	RCP
39	32.81	94.65	24.79	133.00	285.25	5.71	291	RCP
42	34.99	99.82	25.97	147.00	307.79	6.16	314	RCP
45	37.24	105.03	27.15	161.50	330.92	6.62	338	RCP
48	39.54	110.27	28.33	176.00	354.14	7.08	361	RCP
54	44.31	120.88	30.69	202.50	398.39	7.97	406	RCP
60	49.31	131.65	33.06	229.00	443.02	8.86	452	RCP
66	54.54	142.58	35.42	279.50	512.03	10.24	522	RCP
72	59.99	153.67	37.78	330.00	581.44	11.63	593	RCP
78	65.67	164.91	40.14	392.50	663.22	13.26	676	RCP
84	71.58	176.32	42.50	455.00	745.40	14.91	760	RCP
90	77.72	187.88	44.86	512.50	822.96	16.46	839	RCP
96	84.08	199.61	47.22	570.00	900.91	18.02	919	RCP
102	90.67	211.49	49.58	922.50	1,274.24	25.48	1,300	PCCP
108	97.48	223.53	51.94	1,275.00	1,647.96	32.96	1,681	PCCP
120	111.80	248.09	56.67	1,950.00	2,366.56	47.33	2,414	PCCP
132	127.03	273.28	61.39	2,137.50	2,599.20	51.98	2,651	PCCP
144	143.16	299.12	66.11	2,325.00	2,833.39	56.67	2,890	PCCP
168	178.15	352.68	75.56	2,700.00	3,306.39	66.13	3,373	PCCP

APPENDIX 3-7



APPENDIX 3-7
WATER DEMANDS IN PA AMERICAN PORTION OF THE CITY

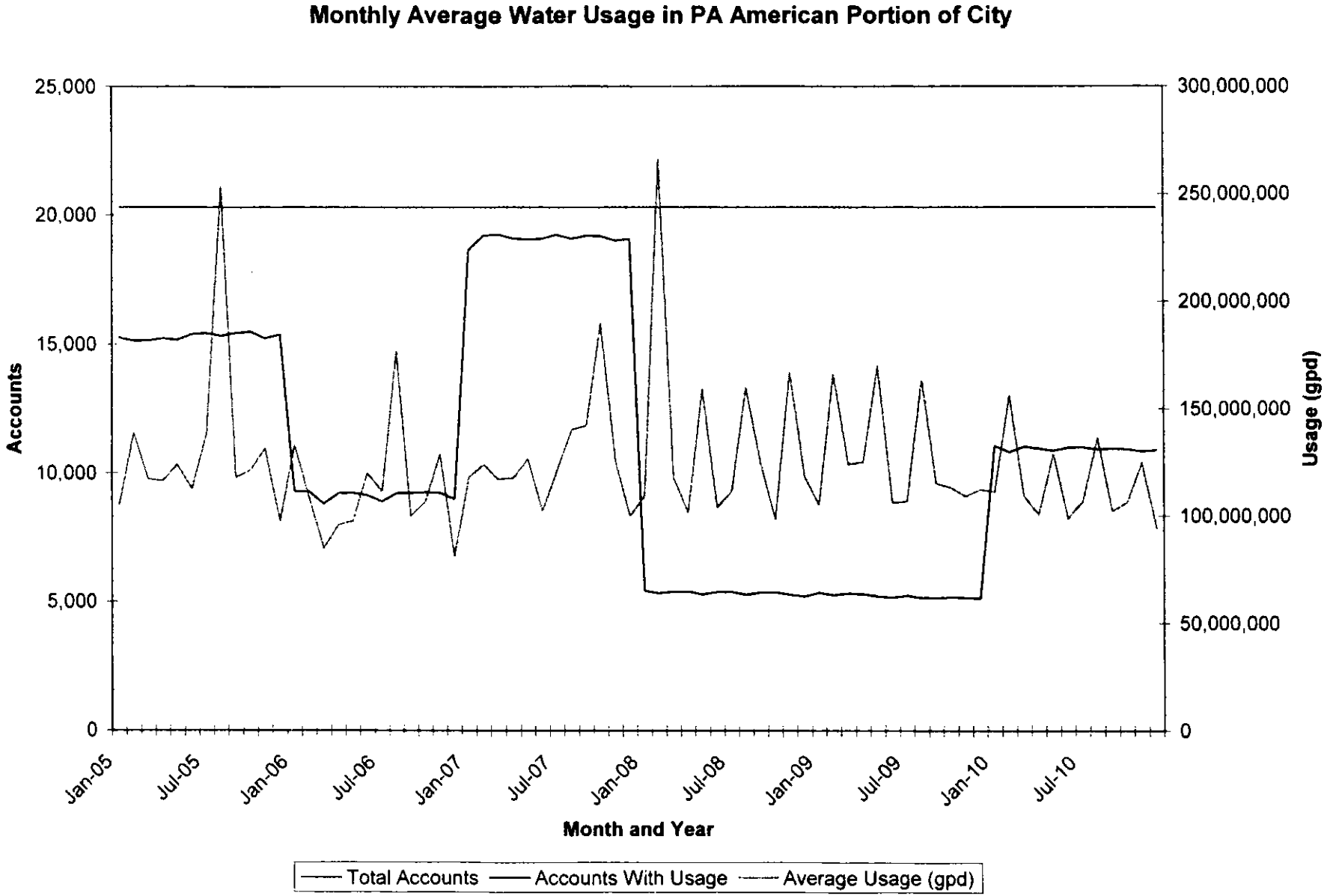
PWSA 40-Year Plan
Metered Water Usage in Portion of City Served By PA American Water Company

Month	All Accounts	Accounts With Usage	Average Usage per Account (gal/month)	Estimated Total Usage for All Accounts (gal/month)	Average Usage (gpd)
Jan-05	20,304	15,258	5,162	104,804,933	3,380,804
Feb-05	20,304	15,135	6,866	139,410,481	4,978,946
Mar-05	20,304	15,145	5,779	117,332,944	3,784,934
Apr-05	20,304	15,236	5,739	116,518,639	3,883,955
May-05	20,304	15,178	6,110	124,055,979	4,001,806
Jun-05	20,304	15,389	5,545	112,586,536	3,752,885
Jul-05	20,304	15,433	6,828	138,640,235	4,472,266
Aug-05	20,304	15,330	12,502	253,837,388	8,188,303
Sep-05	20,304	15,427	5,810	117,969,354	3,932,312
Oct-05	20,304	15,482	5,975	121,323,804	3,913,671
Nov-05	20,304	15,223	6,484	131,652,490	4,388,416
Dec-05	20,304	15,371	4,791	97,284,000	3,138,194
Jan-06	20,304	9,293	6,567	133,336,860	4,301,189
Feb-06	20,304	9,284	5,354	108,697,873	3,882,067
Mar-06	20,304	8,799	4,185	84,976,267	2,741,170
Apr-06	20,304	9,216	4,718	95,791,122	3,193,037
May-06	20,304	9,222	4,808	97,620,014	3,149,033
Jun-06	20,304	9,136	5,919	120,176,033	4,005,868
Jul-06	20,304	8,886	5,482	111,313,241	3,590,750
Aug-06	20,304	9,212	8,728	177,212,190	5,716,522
Sep-06	20,304	9,228	4,923	99,948,238	3,331,608
Oct-06	20,304	9,255	5,257	106,747,467	3,443,467
Nov-06	20,304	9,229	6,359	129,108,760	4,303,625
Dec-06	20,304	8,987	3,997	81,153,412	2,617,852
Jan-07	20,304	18,658	5,822	118,204,710	3,813,055
Feb-07	20,304	19,198	6,107	123,997,531	4,428,483
Mar-07	20,304	19,240	5,771	117,171,126	3,779,714
Apr-07	20,304	19,099	5,804	117,836,607	3,927,887
May-07	20,304	19,049	6,246	126,823,431	4,091,078
Jun-07	20,304	19,083	5,042	102,372,255	3,412,409
Jul-07	20,304	19,233	5,971	121,243,103	3,911,068
Aug-07	20,304	19,084	6,921	140,530,625	4,533,246
Sep-07	20,304	19,199	7,011	142,350,334	4,745,011
Oct-07	20,304	19,186	9,349	189,816,438	6,123,111
Nov-07	20,304	19,008	6,203	125,948,920	4,198,297
Dec-07	20,304	19,076	4,921	99,907,966	3,222,838
Jan-08	20,304	5,429	5,385	109,341,412	3,527,142
Feb-08	20,304	5,332	13,108	266,145,906	9,177,445
Mar-08	20,304	5,401	5,809	117,952,466	3,804,918
Apr-08	20,304	5,396	5,006	101,637,719	3,387,924
May-08	20,304	5,283	7,855	159,483,370	5,144,625
Jun-08	20,304	5,376	5,128	104,115,131	3,470,504
Jul-08	20,304	5,381	5,490	111,477,389	3,596,045
Aug-08	20,304	5,277	7,881	160,022,865	5,162,028

Sep-08	20,304	5,362	6,127	124,404,789	4,146,826
Oct-08	20,304	5,372	4,849	98,446,544	3,175,695
Nov-08	20,304	5,275	8,238	167,263,713	5,575,457
Dec-08	20,304	5,211	5,823	118,231,178	3,813,909
Jan-09	20,304	5,349	5,181	105,200,930	3,393,578
Feb-09	20,304	5,258	8,196	166,405,058	5,943,038
Mar-09	20,304	5,323	6,114	124,140,182	4,004,522
Apr-09	20,304	5,299	6,163	125,126,387	4,170,880
May-09	20,304	5,208	8,369	169,928,675	5,481,570
Jun-09	20,304	5,165	5,225	106,091,545	3,536,385
Jul-09	20,304	5,243	5,256	106,723,830	3,442,704
Aug-09	20,304	5,162	8,081	164,083,409	5,293,013
Sep-09	20,304	5,160	5,676	115,235,734	3,841,191
Oct-09	20,304	5,179	5,579	113,280,258	3,654,202
Nov-09	20,304	5,165	5,378	109,189,357	3,639,645
Dec-09	20,304	5,137	5,527	112,229,828	3,620,317
Jan-10	20,304	11,068	5,484	111,340,679	3,591,635
Feb-10	20,304	10,830	7,700	156,335,584	5,583,414
Mar-10	20,304	11,039	5,383	109,304,751	3,525,960
Apr-10	20,304	10,967	4,952	100,549,277	3,351,643
May-10	20,304	10,880	6,364	129,215,895	4,168,255
Jun-10	20,304	11,009	4,873	98,950,789	3,298,360
Jul-10	20,304	11,011	5,255	106,703,386	3,442,045
Aug-11	20,304	10,929	6,735	136,744,807	4,411,123
Sep-10	20,304	10,957	5,028	102,094,766	3,403,159
Oct-10	20,304	10,941	5,236	106,301,886	3,429,093
Nov-10	20,304	10,858	6,149	124,854,708	4,161,824
Dec-10	20,304	10,901	4,649	94,396,997	3,045,064
Average Month (gpd)					4,106,861
Maximum Month (gpd)					9,177,445

Year	No. of Customers	Average Usage (gpd)	GPD per Customer
2005	20,304	4,318,041	213
2006	20,304	3,689,682	182
2007	20,304	4,182,183	206
2008	20,304	4,498,543	222
2009	20,304	4,168,420	205
2010	20,304	3,784,298	186
Average metered usage (gpd)		4,106,861	202
Average water demand (gpd) *		6,844,769	

* Includes "unaccounted for" and "other" water



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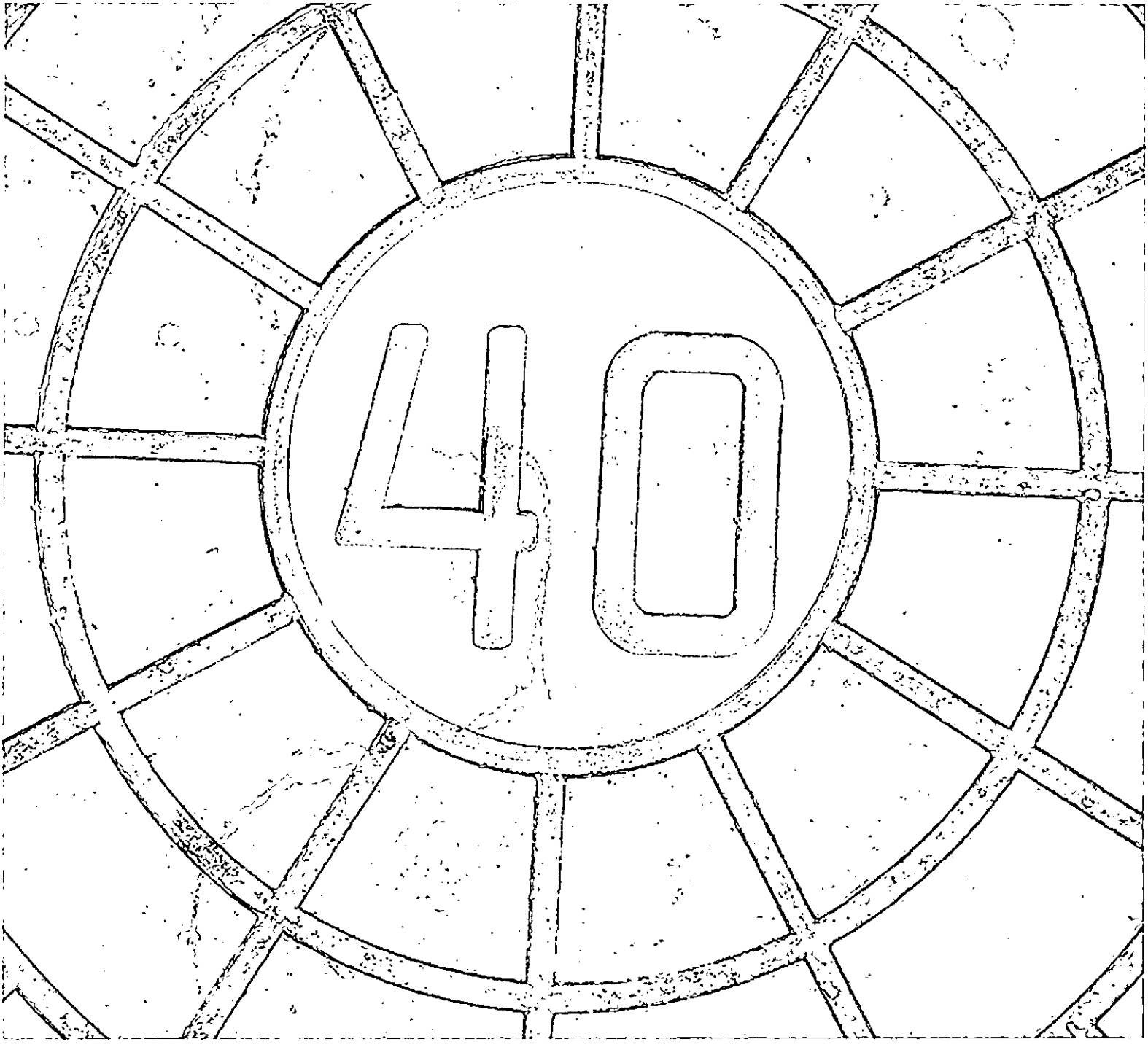
APPENDIX 3-8



Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
Aspinwall P.S.	Pump 1 - Centrifugal, 2 Stage	Worthington	18-LCS-3 / 1521127	8,500 gpm @ 265 ' TDH	1	1958	52	Good
	Pump 2 - Centrifugal, 2 Stage	Worthington	18-LCS-3 / 1521126	10,420 gpm @ 265 ' TDH	1	1958	52	Good
	Pump 3 - Centrifugal, 2 Stage	Worthington	20-LCS-4 / 1521125	15,278 gpm @ 265 ' TDH	1	1958	52	Good
	Pump 4 - Centrifugal, 2 Stage	Worthington	20-LCS-4 / 1521124	19,500 gpm @ 265 ' TDH	1	1958	52	Good
	Motor 1 - Synchronous, 2300 V	Westinghouse	N.A.	1,000 HP 1,200 RPM	1	1958	52	Good
	Motor 2 - Synchronous, 2300 V	Westinghouse	2557 / P621	1,000 HP 1,200 RPM	1	1958	52	Good
	Motor 3 - Synchronous, 2300 V	Westinghouse	1557 / P623	1,500 HP 720 RPM	1	1958	52	Good
	Motor 4 - Synchronous, 2300 V	Westinghouse	2557 / P623	1,500 HP 720 RPM	1	1958	52	Good
	Motor Control Center							Upgrade - Replace Electronic Protection Modules (GE- multilins) Switchgear Contactor DC Batteries - Good
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger needs replaced with a UPS and replace RTU Inverter
	- Emergency Generator							Non-functional - Replace with Emergency Light Units
Bruecken P.S.	Pump 2 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22640; 22641	19,450 gpm @ 365 ' TDH	1	1932	78	Rebuilt in 2010
	Pump 3 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22639; 22642	19,450 gpm @ 365 ' TDH	1	1932	78	Rebuilt in 2010
	Pump 4 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22643; 22644	19,450 gpm @ 365 ' TDH	1	1932	78	Seal bearing housings to keep water out of bearings
	Pump 5 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22645; 22646	16,700 gpm @ 272 ' TDH	1	1932	78	Good
	Pump 6 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22648; 22647	16,700 gpm @ 272 ' TDH	1	1932	78	Rebuilt in 2009
	Pump 7 - Centrifugal, 2 Stage	Allis Chalmers	SG30/24 22650; 22649	16,700 gpm @ 272 ' TDH	1	1932	78	Good
	Motor 2 - Synchronous, 2300 V	Allis Chalmers	128569	2,250 HP 720 RPM	1	1932	78	Rebuilt in 2007
	Motor 3 - Synchronous, 2300 V	Allis Chalmers	128226	2,250 HP 720 RPM	1	1932	78	Rebuilt in 2010
	Motor 4 - Synchronous, 2300 V	Allis Chalmers	128573	2,250 HP 720 RPM	1	1932	78	Good
	Motor 5 - Synchronous, 2300 V	Allis Chalmers	128494	2,250 HP 720 RPM	1	1932	78	Rebuilt in 2008
	Motor 6 - Synchronous, 2300 V	Allis Chalmers	128219	1,500 HP 720 RPM	1	1932	78	Rebuilt in 2009
	Motor 7 - Synchronous, 2300 V	Allis Chalmers	128557	1,500 HP 720 RPM	1	1932	78	Good

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Motor Control Center							Upgraded in 1992. Needs serviced / cleaned. Replace Agastat & Priming Relays
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger needs replaced with a UPS and replace RTU Inverter
	-Back-up Power - Dual Power Supply from Utility Co.							
	- Emergency Generator - Serves Flood Pumps							Good
Fox Chapel P.S.	Pump 1 - Centrifugal, 1 Stage	Ingersoll Dresser	SC/LG/ 0698-8852A	2,400 gpm @ 375'	1	1999	11	Good
	Pump 2 - Centrifugal, 1 Stage	Ingersoll Dresser	SC/LG/ 0698-8853	2,400 gpm @ 375'	1	1999	11	Good
	Pump 3 - Centrifugal, 1 Stage	Ingersoll Dresser	SC/LG/ 0698-8852B	2,400 gpm @ 375'	1	1999	11	Good
	Pump 4 - Centrifugal, 2 Stage	Ingersoll Dresser	8GT/ 0698-8854	1,800 gpm @ 588'	1	1999	11	Good
	Motor 1 - Induction, 460 V	Marathon	MV204/ 890-7/3-01	400 HP 1,785 RPM	1	1999	11	Good
	Motor 2 - Induction, 460 V	Marathon	MV204/ 890-7/7-02	400 HP 1,785 RPM	1	1999	11	Good
	Motor 3 - Induction, 460 V	Marathon	MV204/ 890-7/7-03	400 HP 1,785 RPM	1	1999	11	Good
	Motor 4 - Induction, 460 V	Marathon	MV204/ 900-7/7	500 HP 1,785 RPM	1	1999	11	Good
	Motor Control Center							Good
	Emergency Power Backup							None
Herron Hill P.S.	Pump 1 - Centrifugal, 2 Stage	Worthington	10LR-178/763368	5,000 gpm @ 234 ' TDH	1	1988	22	Good
	Pump 2 - Centrifugal, 2 Stage	Worthington	10LR-178/763367	5,000 gpm @ 234 ' TDH	1	1988	22	Good
	Pump 3 - Centrifugal, 2 Stage	Worthington	8LR-20A/763369	3,500 gpm @ 222 ' TDH	1	1988	22	Good
	Pump 4 - Centrifugal, 1 Stage	Worthington	6LR-18/763370	2,083 gpm @ 254 ' TDH	1	1988	22	Good
	Pump 5 - Centrifugal, 2 Stage	Worthington	10LR-18A/763371	6,944 gpm @ 370 ' TDH	1	1988	22	Good
	Pump 6 - Centrifugal, 1 Stage	Worthington	ALR-123/763372	1,389 gpm @ 97 ' TDH	1	1988	22	Good
	Motor 1 - Induction, 4000 V	US Motor	R02P085010,7R-1	350 HP 1,780 RPM	1	1988	22	Good
	Motor 2 - Induction, 4000 V	US Motor	R02P085011,4R-1	350 HP 1,780 RPM	1	1988	22	Good
	Motor 3 - Induction, 4000 V	US Motor	R02P085012,2R-1	300 HP 1,775 RPM	1	1988	22	Good
	Motor 4 - Induction, 4000 V	US Motor	R02P085013,9R-1	200 HP 1,780 RPM	1	1988	22	Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Motor 5 - Induction, 4000 V	US Motor	R02P085014,9R-1	500 HP 1,775 RPM	1	1988	22	Good
	Motor 6 - Induction, 440 V	US Motor	R02P085022,4R-1	75 HP 1,785 RPM	1	1988	22	Good
	Motor Control Center							Fair Condition, Evaluate Pump #6 Switchgear
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger needs replaced with a UPS and replace RTU Inverter
	-Back-up Power - Dual Power Supply from Utility Co.							Recommend Auto Transfer Switch
Herron Hill Tank P.S.	Pump 1 - Centrifugal, 1 Stage	Peerless	00806614R?	1,181 gpm @ 130 ' TDH	1	1963	47	Good
	Pump 2 - Centrifugal, 1 Stage	Peerless	N.A.	1,181 gpm @ 130 ' TDH	1	1963	47	Suction Valves are Bad. Will Be Replaced.
	Motor 1 - Induction, 460 V	U.S. Electric Motor	3525298	50 HP 1,800 RPM	1	1963	47	Good
	Motor 2 - Induction, 460 V	U.S. Electric Motor	N.A.	50 HP 1,800 RPM	1	1963	47	Good
	Motor Control Center							Needs to be evaluated
	RTU/SCADA							Will be replaced
	Emergency Generator - Owned by EOC - Serves Scada and Lighting							Owned by "Emergency Operations Center"
Highland P.S.	Pump 1 - Centrifugal, 1 Stage	Aurora	411-BF / 82-10074-1	1,650 gpm @ 270 ' TDH	1	1983	27	Sized wrong, 3600 RPM; Frequent Failure
	Pump 2 - Centrifugal, 1 Stage	Aurora	411-BF / 82-10074-2	1,650 gpm @ 270 ' TDH	1	1983	27	Sized wrong, 3600 RPM; Impeller was cut
	Pump 3 - Centrifugal, 2 Stage	Aurora	82-10075	2,100 gpm @ 280 ' TDH	1	1983	27	Good
	Motor 1 - Induction, 460 V	Marathon	MH-405-TS/TDS700-1GNW	150 HP 3,500 RPM	1	1983/2009	27	Replaced 2009
	Motor 2 - Induction, 460 V	Marathon	MH-405STTD/5701GNW	150 HP 3,500 RPM	1	1983/2008	27	Rebuilt 2009
	Motor 3 - Induction, 460 V	Marathon	LD44FTS/TD57026ECW	200 HP 1,780 RPM	1	1983	27	
	Motor Control Center							Needs Evaluated; Unreliable
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger and RTU Inverter - Good Condition

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
Highland	Membrane Filtration Plant							
Membrane Filtration								
Plant	Rotating Strainers	Kinney	20AP	10 MGD	2	2002		Good
	Feed Pump No. 1	Peerless	Type AE	8.78 MGD @ 120 '	1	2002		Good - Rebuilt & Upgraded 2009
	Feed Pump No. 2	Peerless	Type AE	8.78 MGD @ 120 '	1	2002		Good - Rebuilt & Upgraded 2009
	Feed Pump No. 3	Peerless	Type AE	8.78 MGD @ 120 '	1	2002		Good - Rebuilt & Upgraded 2009
	Feed Pump No. 4	Peerless	Type AE	8.78 MGD @ 120 '	1	2002		Good - Rebuilt & Upgraded 2009
	Feed Pump No. 1 Motor							
	Feed Pump No. 2 Motor							
	Feed Pump No. 3 Motor							
	Feed Pump No. 4 Motor							
	Filtering Module Racks: A through J 80 Modules Each X 10 = 800 Total	Pall Corp.		2.6 MGD	10	2009		Good - Rebuilt & Upgraded 2009
	Filter Valve Racks; A through J	Pall Corp.				2002 / 09		Good - Rebuilt & Upgraded 2009
	Brush Filters, Filter Gallery	Amiad	2.08312E+12		10	2009		Poor Design - Modifications Needed
	Backwash Recovery Tank, Pump Rm	Edwards	4693/ 03017101	5,000 Gal	1	2002		Good
	Backwash Feed Pump #1	Peerless	F11030AP-BF/ 992700004293	600 GPM @ 150 PSI	1	2009		Good
	Backwash Feed Pump #2	Peerless	F11030AP-BF/ 992700004293	600 GPM @ 150 PSI	1	2009		Uninstalled
	Backwash Pump Motor #1	General Electric	5K5254/ 92081405	15 HP @ 1,760 RPM	1	2009		Good
	Backwash Pump Motor #2	General Electric	5K5254/ 92081405	15 HP @ 1,760 RPM	1	2009		Uninstalled
	Basket Strainer, Caustic Room	Hayward	BS204001/16		1	2009		Good
	Backwash Water Filter Module Rack, 56 modules	Pall Corp.			1	2005		Good
	Backwash Water Filter Module Valve Rack	Pall Corp.				2005		Good
	Backwash Brush Filter, Pump Room	Amiad	6202ZC01/ VP4X		1	2007		Good
	Hypochlorite Storage Tank #1	Edwards	4695/ 03017101	2,800 Gal	1	2002		Good
	Hypochlorite Storage Tank #2	Edwards	4694/ 03017101	2,800 Gal	1	2002		Good
	Hypochlorite Transfer Pump	Goulds	GB10M	30 GPM @ 20 PSI	1	2009		Good
	Hypochlorite Day Tank, Chlorine Rm	Edwards	4696/ 03017101	150 Gal	1	2002		Good
	Hypochlorite Dosing Pumps	Prominent Sigma	C1M34D18F28B	11 GPM	2	2006		Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Chlorine Flow Meter	Krohne	IFC020/ A0218233		1	2002		Good
	CCM Tank w/ Heater, Caustic Rm	Edwards	4689/ 03017101	1,500 Gal	1	2002		Good
	Acid CIP Tank w/ Heater, Acid Rm	Edwards	4690/ 03017101	1,500 Gal	1	2002		Good
	CIP Circulation Pump, Caustic Rm	Grundfoss	CRN-4	300 GPM	1	2002		Good
	Castic Transfer Pump, Caustic Rm	Vanton		19 GPM 3/4 HP	1	2002		
	Neutralization Tank, Chlorine Rm	Edwards	4692/ 03017101	4,000 Gal	1	2002		Good
	Neutralization Tank Mixer, Chlorine Rm	Chemineer	5JTC	1 HP 1,200 RPM	1	2002		Good
	4" Vertical Pump, Acid Rm	Grundfos	CR-1	20 GPM @ 145 PSI	1	2010		Good
	Acid Dosing Pump, Acid Rm	Chem-Tainer	7B42	140 GPM @ 42 PSI	1	2004		Good
	Air Compressor, 2nd Floor	Atlas Copco	APCE3055C98/38/972		2	2009		Good
	Acid Dosing Pump, Acid Rm	Chem-Tainer	7B42	140 GPM @ 42 PSI	1	2004		Good
	Air Compressor, 2nd Floor	Atlas Copco	APCE3055C98/38/972		2	2009		Good
	Hypochlorite Transfer Pump	Goulds	GB10M	30 GPM @ PSI	1	2009		Good
	Day Tank, Chlorine Rm	Edwards	4696/ 03017101	Gal	1	2002		Good
	Chemical Mixer, Chlorine Rm	Chemineer	5JTD	HP RPM	1	2002		Good
	Hypochlorite Pumps	Prominent Sigma	C1M34D18F28B	11 GPM @	2	2006		Good
	Chlorine Flow Meter	Krohne	IFC020/ A0218233		1	2002		Good
	CCM Tank, Caustic Rm	Edwards	4689/ 03017101	Gal	1	2002		Good
	Caustic CIP Tank	Edwards	4690/ 03017101	1,500 Gal	1	2002		Good
	Acid CIP Tank	Edwards	4690/ 03017101	1,500 Gal	1	2002		Good
	CIP Circulation Pump	Vanton	CC	300 GPM @ PSI	1	2002		Good
	Neutralization Tank, Chlorine Rm	Edwards	4692/ 03017101	4,000 Gal	1	2002		Good
	Chemical Mixer, Chlorine Rm	Chemineer	5JTC	HP RPM	1	2002		Good
	4" Vertical Pump, Acid Room	Grundfos	CR-1	GPM @ PSI	1	2010		Good
	Dosing Pump	Chem-Tainer	7B42	GPM @ PSI	1	2004		Good
	Air Compressor, 2nd Floor	Atlas Copco	APCE3055C98/38/972		2	2009		Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
Howard P.S.	Pump 1 - Centrifugal, 2 Stage	Aurora	87-21321	5,200 gpm @ 270 ' TDH	1	1998	22	Good
	Pump 2 - Centrifugal, 2 Stage	Aurora	87-21322	5,200 gpm @ 270 ' TDH	1	1998	22	Good
	Pump 3 - Centrifugal, 2 Stage	Peerless	444867	2,100 gpm @ 270 ' TDH	1	1998	22	Good
	Pump 4 - Centrifugal, 2 Stage	Peerless	444868	2,100 gpm @ 270 ' TDH	1	1998	22	Good
	Pump 5 - Centrifugal, 2 Stage	Peerless	444153	1,750 gpm @ 480 ' TDH	1	1998	22	Planning to rebuild
	Pump 6 - Centrifugal, 2 Stage	Peerless	AE817Q	3,500 gpm @ 440 ' TDH	1	2010	1	Excellent
	Pump 7 - Centrifugal, 2 Stage	Peerless	AE817Q	3,500 gpm @ 440 ' TDH	1	2010	1	Excellent
	Motor 1 - Induction, 2300 V	General Electric	TB242003	500 HP 1,785 RPM	1	1998	22	Good
	Motor 2 - Induction, 2300 V	General Electric	TB241001	500 HP 1,785 RPM	1	1998	22	Good
	Motor 3 - Induction, 2300 V	US Motor	N.A.	200 HP 1,780 RPM	1	1998	22	Good
	Motor 4 - Induction, 2300 V	US Motor	N.A.	200 HP 1,780 RPM	1	1998	22	Good
	Motor 5 - Induction, 2300 V	US Motor	108P0440391C-01	300 HP 1,775 RPM	1	1998	22	Clean & replace bearings
	Motor 6 - Induction, 2300 V	Emerson	N.A.	500 HP 1,770 RPM	1	2010	1	Excellent
	Motor 7 - Induction, 2300 V	Emerson	N.A.	500 HP 1,770 RPM	1	2010	1	Excellent
	Motor Control Center							Needs Replaced, including DC power supply
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger needs replaced with a UPS and replace RTU Inverter
	-Back-up Power - Dual Power Supply from Utility Co.							
Lincoln P.S.	Pump 1 - Centrifugal, 1 Stage	DeLaval	K 8/6 / 254857	1,400 gpm @ 310 ' TDH	1	1952	58	Fair
	Pump 2 - Centrifugal, 1 Stage	DeLaval	K 8/6 / 254855	1,400 gpm @ 310 ' TDH	1	1952	58	Out of Service, being replaced
	Pump 3 - Centrifugal, 2 Stage	DeLaval	K 8/6 / 254856	1,400 gpm @ 310 ' TDH	1	1952	58	Fair
	Motor 1 - Induction, 440 V	Elliot	121459	150 HP 1,760 RPM	1	1952	58	Fair
	Motor 2 - Induction, 440 V	Elliot	121461	150 HP 1,760 RPM	1	1952	58	Fair
	Motor 3 - Induction, 440 V	Elliot	121463	150 HP 1,760 RPM	1	1952	58	Fair
	Motor Control Center							Needs evaluated to determine deficiencies
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger and RTU Inverter - Working Condition, But Old
Millvale	Pump 1 - Centrifugal	Cornell	4RB/94227	1,000 gpm @ 145' TDH	1	1996	14	Out of Service & never put on-line

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
Millvale	Pump 2 - Centrifugal	Cornell	4RB/94226	1,000 gpm @ 145' TDH	1	1996	14	Out of Service & never put on-line
Millvale	Motor 1 - Induction	Baldor	596C	50 HP 1,775 RPM	1	1996	14	Out of Service & never put on-line
Millvale	Motor 2 - Induction	Baldor	596C	50 HP 1,775 RPM	1	1996	14	Out of Service & never put on-line
Mission P.S.	Pump 1 - Centrifugal, 2 Stage	DeLaval	2 / 260689	4,170 gpm @ 388 'TDH	1	1958	52	Good
	Pump 2 - Centrifugal, 2 Stage	DeLaval	2 / 260690	4,170 gpm @ 388 'TDH	1	1958	52	Good
	Pump 3 - Centrifugal, 2 Stage	DeLaval	2 / 260691	4,170 gpm @ 388 'TDH	1	1958	52	Good
	Pump 4 - Centrifugal	Worthington	12LNH32/70032361	8,400 gpm @ 388 'TDH	1	1992	18	Good
	Pump 5 - Centrifugal	Worthington	10LNH22/7003237	5,600 gpm @ 388 'TDH	1	1992	18	Good
	Motor 1 - Synchronous, 2300 V	Elliot	25-10424	500 HP 1,200 RPM	1	1958	52	Good
	Motor 2 - Synchronous, 2300 V	Elliot	IS-10424	500 HP 1,200 RPM	1	1958	52	Good
	Motor 3 - Synchronous, 2300 V	Elliot	SS-10424	500 HP 1,200 RPM	1	1958	52	Good
	Motor 4 - Synchronous, 2300 V	Westinghouse	5299AA1	1,250 HP 1,250 RPM	1	1992	18	Good
	Motor 5 - Synchronous, 2300 V	Westinghouse	5299BA1	700 HP 1,280 RPM	1	1992	18	Good
	Motor Control Center - Pumps 1-3							Fair Condition - Need\s to be Evaluated
	Motor Control Center - Pumps 4 & 5					1992		Excellent
	RTU / SCADA							Being Replaced
	Emergency Power Backup							
	- RTU / SCADA							Backup Batteries & Charger and RTU Inverter - Good Condition
	-Back-up Power - Dual Power Supply from Utility Co.							
Inline Pump Station Coral & Pacific	Pump 1 - Centrifugal In-line	PACO	1595-5/KRM01061A	100 gpm @ 70 'TDH	1	1981	29	Good
(In Ground Package)	Pump 2 - Centrifugal In-line	PACO	2095-1/3TF12132	200 gpm @ 70 'TDH	1	1981	29	Needs Replaced
	Motor 1 - Induction	Reliance		5 HP 1,750 RPM	1	1981	29	Good
	Motor 2 - Induction	Reliance		8 HP 1,750 RPM	1	1981	29	Needs Replaced
Saline P.S	Pump 1 - Centrifugal, 2 Stage	Allis Chalmers	A1/8AE17Q	2,800 gpm @ 376 'TDH	1	2010	1	Rebuilt Stg 1 & Replaced Stg 2 in 2010
Saline P.S	Pump 2 - Centrifugal, 2 Stage	Allis Chalmers	01-2/87139673	2,800 gpm @ 376 'TDH	1	1988	22	Rebuilt in 2010
Saline P.S	Pump 2 - Centrifugal, 2 Stage	Allis Chalmers	02-2/87139673	2,800 gpm @ 376 'TDH		1988	22	
Saline P.S	Pump 3 - Centrifugal, 2 Stage	Allis Chalmers	A-1/871-39673-05-1	1,200 gpm @ 400 'TDH	1	1987	23	
Saline P.S	Motor 1 - Induction, 4160 V	General Electric	5KS511A,N2002HB	400 HP 1,790 RPM	1	1987	23	

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Saline P.S	Motor 2 - Induction, 4160 V	General Electric	R8184005	400 HP 1,790 RPM	1	1988	22	
Saline P.S	Motor 3 - Induction, 4160 V	General Electric	58202002	200 HP 1,790 RPM	1	1987	22	
Saline P.S	Motor Control Center							Operates reliability, but should be evaluated and tested
Saline P.S	RTU / SCADA							Being Replaced
Saline P.S	Emergency Power Backup							
Saline P.S	- RTU / SCADA							Backup Batteries & Charger needs replaced with a UPS and replace RTU Invertor
Water Filtration Plant East Raw Water Intakes	East Raw Water Intakes - Bar Screen				2	1928		Poor Condition
	East Sluice Gate Valve	Rodney Hunt		84 inch	1	1928		Fair
	West Sluice Gate Valve	Rodney Hunt		84 inch	1	1928		Fair
	East Valve Actuator Control System	Dean			1	1928		Fair
	West Valve Actuator Control System	Dean			1	1928		Fair
	Sample Pump, 3 x 2	STA-RITE	DHF3-51	HP RPM	1			Good
	Sample Pump Motor	STA-RITE	P48L2EB7	2 HP 3,450 RPM	1			Good
Water Filtration Plant West Raw Water Intakes	East Sluice Gate Valve	Copfinrail Bearing Stand			1	1906		Fair, in Open position
	West Sluice Gate Valve	Copfinrail Bearing Stand			1	1906		Poor Dismantled; In Closed position: Needs Gear Assembly Rebuilt
	Sluice Gate Valves - River Side of Chamber				8	1906		Not Used; All in Open Position
	BW Retention Basin Mixer	Lightnin	204H1		1			Good
	BW Retention Basin Mixer Motor	Allis Chalmer	51-447-270-4461	3 HP 1,740 RPM	1			Good
Water Filtration Plant - Ross PS - Raw Water Pumps and Equipment	Pump 1 - Centrifugal, 1 Stage	DeLaval	X-48 / 79387	60,417 gpm @ 57 ' TDH	1	1928	82	Rebuilt 2008
	Pump #1 Oiling Hydraulic Unit	Weinman Pump & Supply	60-1K5-14D-66/ A2851-2		1			Good
	Pump #1 Hydraulic Unit Motor #1	Master	Style 200456/ CZ-15601	0.5 HP @ 1,725 RPM	1			Good
	Pump #1 Hydraulic Unit Motor #2	Master	Style 200456/ DP3679	0.5 HP @ 1,725 RPM	1			Good
	Pump 2 - Centrifugal, 1 Stage	DeLaval	W 42/36 / 79388	34,750 gpm @ 57 ' TDH	1	1928	82	Rebuilt 2009

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Pump #2 Oiling Hydraulic Unit	Weinman Pump & Supply	60-1K5-14D-66/ A2851-1		1			Good
	Pump #2 Hydraulic Unit Motor #1	Master	Style 200456/ CZ-15596	0.5 HP @ 1,725 RPM	1			Good
	Pump #2 Hydraulic Unit Motor #2	Master	Style 200456/ CZ15597	0.5 HP @ 1,725 RPM	1			Good
	Pump 3 - Centrifugal, 1 Stage, two 25 mgd pumps in parallel	DeLaval	P 30/24 / 280396 & 280398	17,360 gpm @ 57 ' TDH	1	1956	54	Rebuilt 2010
	Pump 4 - Centrifugal, 1 Stage	DeLaval	X54/48 / 251298	81,250 gpm @ 58 ' TDH	1	1956	62	Being Rebuilt for 2011
	Pump #4 Oil / Water Separator	DeLaval	54-11/ 3517783		1			Out of Service: To Be Eliminated
	Pump 5 - Centrifugal, 1 Stage	DeLaval	X-48 / 15919	76,289 gpm @ 56 ' TDH	1	1913	97	Good
	Motor 1 - Synchronous, 2300 V	Westinghouse	1667D936	1,000 HP 340 RPM	1	1960	50	Will be inspected / tested in 2011
	Motor 2 - Wound Rotor, 2300 V	Westinghouse	18-57P938	600 HP 410 RPM	1	1960	50	Rebuilt 2004
	Motor 3 - Synchronous, 2300 V	Elliot	4044-MO6018	700 HP 600 RPM	1	1956	54	Reconditioned 2010
	Motor 4 - Synchronous, 2300 V	Elliot	4257-MO6259	1,250 HP 327 RPM	1	1948	62	Being Rebuilt for 2011
	Motor 5 - Synchronous, 2300 V	Elliot	8006-MO6708	1,500 HP 320 RPM	1	1949	61	Will be inspected/tested in 2011
	Pump #5 Hydraulic Unit	Weinman Pump & Supply	60-1K5-14D-F5C/ A4231		1			Good
	Pump #5 Hydraulic Unit Motor	Reliance		0.5 HP @ 1,725 RPM	1			Good
	Priming Pumps							
	East Priming Pump	SIHI Pump Limited	C07632075-01	GPM @ TDH	1			Good
	West Priming Pump	SIHI Pump Limited	5K5184SE205D8/ PJK44011814	GPM @ TDH	1			Good
	East Priming Pump Motor	GE	STK911093/ ID #P56E1302N-GP	5 HP @ 1,755 RPM	1			Good
	West Priming Pump Motor	Reliance	ID # P18F12V.Q	5 HP @ 1,710 RPM	1			Good
	Electrical Equipment							
	Motor Control Center					1956		Being Replaced in 2011
	AC Generator (Serving Chemical Bldg, Pump Room Lights & Valves, EDP-1 &	Stamford	PH13008590/ 463Ho4	313 KVA / 250 KW	1	2005	5	Good
	Emergency Power Backup - AC Generator Motor	Cummins	GTA855G3/ 25297627	HP 1,800 RPM	1	2005	5	Good
	E-Power Transfer Switch	Cummins	1040692543			2005	5	Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Emergency Power Distribution Panelboard	Eaton / Cutler Hammer	PRL4		1	2005	5	Good
	Boiler System E-Power Transformer	Manufacturing Transformer Group	MK150KB/ PK150KBAH3	150 KVA	1	2005	5	Good
	Emergency Power Backup - AC Generator Motor	Cummins	GTA855G3/ 25297627	HP 1,800 RPM	1	2005	5	Good
	E-Power Transfer Switch	Cummins	DTPCD1000/ 1040692543			2005	5	Good
	Emergency Power Distribution Panelboard	Eaton / Cutler Hammer	PRL4		1	2005	5	Good
	Boiler System E-Power Transformer	Hammond Manufacturing Transformer Group	MK150KB/ PK150KBAH3	150 KVA	1	2005	5	Good
Water Treatment Plant Boiler System at Ross Pump Station	Boilers							
	Package Boiler #1 - NG / Oil	Clever Brooks	CB-LE 200.600.150	24,494 MBTUH @ 150 Psi	1	2002		Good
	Package Boiler #2 - NG / Oil	Clever Brooks	CB-LE 200.600.150	24,494 MBTUH @ 150 Psi	1	2002		Good
	Boiler #1 Blower Motor	Clever Brooks		30 HP RPM	1	2002		Good
	Boiler #2 Blower Motor	Clever Brooks		30 HP RPM	1	2002		Good
	Boiler #1 Compressor Motor	Marathon Elec	Series E	8 HP @ 1,760 RPM	1	2002		Good
	Boiler #2 Compressor Motor	Marathon Elec	8VF213TTDW4059/ Series E	8 HP @ 1,760 RPM	1	2002		Good
	Boiler #1 Reduction Equipment	Clever Brooks	AP153028		1	2002		Good
	Boiler #2 Reduction Equipment	Clever Brooks	AP153028		1	2002		Good
	Deaerator System - Third Floor							
	Deaerator Tank, Steel (5' dia x 10' SS)	Clever Brooks		1,460 Gal	1	2002		Good
	Boiler Feedwater Pump #1	Grundfos	B42296263P10349US93 9/ Type CR8-100/9 U-G-A Aude	42 GPM @ 404 TDH	1	2002		Good
	Boiler Feedwater Pump #2	Grundfos	B42296263P10349US93 9/ Type CR8-100/9 U-G-A Aude	42 GPM @ 404 TDH	1	2002		Good
	Boiler Feedwater Pump #1Motor	Baldor	Cat # 85600017/ Spec #36H302W385G1	8 HP @ 3,450 RPM	1	2002		Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Boiler Feedwater Pump #2 Motor	WEG	Grundfos Part #85Z81974	10 HP @ 3,450 RPM	1	2002		Good- uninstalled spare also present
	Chemical Solution Tank, PE flat bottom with removable lid			100 Gal	1	2002		Good
	Chemical Solution Tank Mixer #1 with 3-blade impeller on 4' long shaft	GE	5KH36PNB050T	1/4 HP @ 1,750 RPM	1	2002		Good
	Chemical Solution Tank Level Indicator		Probe Type		1	2002		Good
	Chemical Solution Piston Type Feed Pump	Von Weise		HP @ RPM	1	2002		Good
	Chemical Solution Feed Pump Motor	GE		1/4 HP @ 1,725 RPM	1	2002		Good
	Economizer - Third Floor							
	Economizer # 1	Cannon Boiler Works, Inc.	S/O 5124-5100/ FS12SC523	450 PSI @ 650 F	1	2002		Good
	Economizer # 1	Cannon Boiler Works, Inc.	S/O 5124-5100/ FS12SC523	450 PSI @ 650 F	1	2002		Good
	Condensate System - Pump Area							
	Surge Tank, 8' dia x 12' high	Cleaver Brooks	SRG2000/ RG8876	2,000 Gal	1	2001		Good
	Condensate Return Pump #1, 2 x 2.5 x 6	Cleaver Brooks	Type 321-BF/ AS01-50254	100 GPM @ 90' TDH	1			Good
	Condensate Return Pump #2 2 x 2.5 x 6	Cleaver Brooks	Type 321-BF/ AS01-50255	100 GPM @ 90' TDH	1			Good
	Condensate Return Pump Motor #1	Marathon	8VJ182DDTR7602DT/ Part # 950-3641-940	5 HP @ 3,450 RPM	1			Good
	Condensate Return Pump Motor #2	Marathon	8VJ182DDTR7602DT/ Part # 950-3641-940	5 HP @ 3,450 RPM	1			Good
	Condensate Return Pump #1, 2 x 2.5 x 6	Cleaver Brooks	Type 321-BF/ AS01-50254	100 GPM @ 90' TDH	1			Good
	Condensate Return Pump #2 2 x 2.5 x 6	Cleaver Brooks	Type 321-BF/ AS01-50255	100 GPM @ 90' TDH	1			Good
	Condensate Return Pump Motor #1	Marathon	8VJ182DDTR7602DT/ Part # 950-3641-940	5 HP @ 3,450 RPM	1			Good
	Condensate Return Pump Motor #2	Marathon	8VJ182DDTR7602DT/ Part # 950-3641-940	5 HP @ 3,450 RPM	1			Good
	Boiler Chemical Treatment for Feedwater - Boiler Room							
	Chemical Solution Tank #1, PE flat bottom with removable lid			100 Gal	1	2002		Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Chemical Solution Tank #2, PE flat bottom with removable lid			100 Gal	1	2002		Good
	Chemical Solution Tank Mixer #1 with 3-blade impeller on 4' long shaft	GE	5KH36PNB050T	1/4 HP @ 1,725 RPM	1	2002		Good
	Chemical Solution Tank Mixer #2 with 3-blade impeller on 4' long shaft	GE	5KH36PNB050T	1/4 HP @ 1,725 RPM	1	2002		Good
	Chemical Solution Tank #1 Level Indicator		Probe Type		1	2002		Good
	Chemical Solution Tank #2 Level Indicator		Probe Type		1	2002		Good
	Chemical Solution Tanks #1 & #2 Metering Pump	LMI / Milton Roy	C101-94S/ 08022514744-1	1 GPH @ 300 PSI	1	2002		Concern - Pump has high failure rate due to high boiler pressure reqdmt
	Control Panel - Boiler Room	Swindell Dresser				2		
	PLC	Eaton / Cuttler-Hammer	Panelmate Power Pro/					
	Steam Meter Gauge #1 Boiler	Thermal Instrmt Co., Inc	SN 2010262	SCFM	1	2010		Good - Mounted onto SD Panel
	Steam Meter Gauge #2 Boiler	Thermal Instrmt Co., Inc	SN 2010263	SCFM	1	2010		Good - Mounted onto SD Panel
	Generator Meter Gauge	Thermal Instrmt Co., Inc	SN 2010264	SCFM	1	2010		Good - Mounted onto SD Panel
	Conductivity Controller #1	Advance Controls Inc	2B-7M/ G1-146		1	2010		Good - Mounted onto SD Panel
	Conductivity Controller #2	Advance Controls Inc	2B-7M/ G1-145		1	2010		Good - Mounted onto SD Panel
	Boiler Feedwater Water Softener (Located in Chem Room)			100 PSI @ 650 F				
	Resin Tank #1 (3' dia x 6' SS)	Metro MFG. CO.		300 Gal	1	1990		Good But Being Replaced with a Larger Capacity System
	Resin Tank #2 (3' dia x 6' SS)	Metro MFG. CO.		300 Gal	1	1990		Good But Being Replaced with a Larger Capacity System
	Brine Solution Tank, FRP, flat bottom, open removable lid top				1	1990		Good But Being Replaced with a Larger Capacity System
	1.5" Flowmeter #1	Badger	SR/ SN19669-1/ Part # 9823486	0 to 300 GPM	1	1990		Good
	1.5" Flowmeter #2	Badger	SR/ SN19669-1/ Part # 9823486	0 to 300 GPM	1	1990		Good

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
Water Treatment Plant Ross Pump Station Compressed Air Systems	Instrument Air Compressor Basement							
	Instrument Air Compressor	Ingersol Rand	Type ESH-1/ IDC-15	scfm @ psig	1	1959		Fair
	Air Compressor Motor	GE	5K4286A21A5	20 HP @ 1,760 RPM	1			Good
	Air Receiver, bolted Stl tank, 5' dia x 6' high		117.589XR	950 GAL	1	1959		Fair
	Instrument Air Compressor Boiler Room							
	Reciprocating Type Twin Unit with common Receiver tank	Moeller	HPL3D-8/ PL15A02387		1			Good
	Compressor #1	Moeller	PL15A 02387	140 scfm @ 175 psig	1			Good
	Compressor #2	Moeller	PL15A 02415	130 scfm @ 165 psig	1			Good
	Compressor Motor #1	Baldor	Cat #M3111-CH/ Spec #35L101787862	3 HP @ 1,725 RPM	1			Good
	Compressor Motor #2	Baldor	Cat #M3111-CH/ Spec #35L101787862	3 HP @ 1,725 RPM	1			Good
	Instrument Air Compressor Basement							
	Reciprocating Type mounted on Receiver tank	Kruman Equipment Co.	HR 7-8/ R30028798	scfm @ 1,745 RPM	1			Some surface deterioration
	Compressor Receiver Tank (1.5' dia x 5')	Champion	SN R3028798	60 Gal	1			Some surface deterioration
	Compressor Motor	Magnetic Century Electric		7.5 HP @ 1,745 RPM	1			Some surface deterioration
	Instrument Air Compressor Third Floor							
	Backup Reciprocating Air Compression	Brunner Manufacturing Co.	A212/ 147720	scfm @ 1,760 RPM	1	1941	69	Poor
	Compressor Receiver Tank (2' dia x 3' high)	Pressure Steel Co.		Gal	1	1941	69	Poor
	Compressor Motor	Westinghouse		8 HP @ 1,760 RPM	1	1941	69	Poor
	Instrument Air Compressor First Floor							
	Plant Air Compressor, Single Reciprocating type	Ingersol Rand			1			Disconnected

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	Instrument Air Compressor First Floor								
	Plant Air Compressor, Single Reciprocating type	Ingersol Rand	T30251204/ 30T719795	200 psi @	460 F	1			
	Air Compressor Motor	Baldor	NA			1			External deterioration
	AC Receiver, 2' dia x 5' Lg	Brunner Engineering & Manufacturing, Inc.		110 Gal		1			
Water Filtration Plant Sodium Hypochlorite Building	Pretreatment Sodium Hypochlorite								
	Storage Tanks #1 - #4 Fiberglass 12.5% Solution	Augusta Fiberglass Inc.		11,750 Gal	10' dia 22' high	4	2004		Good
	Feed Pump 1 - Metering	US Filter	Encore 700 / 86-45704	160 GPH @	100 PSIG	1	2004		Fair with external rust - Not Used
	Feed Pump 2 - Metering	US Filter	Encore 700 / 86-45701	160 GPH @	100 PSIG	1	2004		Fair with external rust - Not Used
	Feed Pump 3 - Metering	US Filter	Encore 700 / 86-45702	160 GPH @	100 PSIG	1	2004		Fair with external rust - To Be Replaced
	Feed Pump 4 - Metering	Prominent Sigma	WDL 100C /	130 GPH @	100 PSIG	1	2004		Good
	Feed Pump Motor 1	Baldor	N0204120791	1 HP	1,750 RPM	1	2004		Fair with external rust - Not Used
	Feed Pump Motor 2	Baldor	N0204120800	1 HP	1,750 RPM	1	2004		Fair with external rust - Not Used
	Feed Pump Motor 3	Baldor	N0204120740	1 HP	1,750 RPM	1	2004		Fair with external rust - To Be Replaced
	Feed Pump Motor 4	ATB	2157414011110238 10307	0.37 KW	1,750 RPM	1	2004		Good
	Transfer Pump #1	Goulds	3298 / 756E644.1	105 gpm @	25' TDH	1	2004		Good
	Transfer Pump #2	Finish Thompson Inc.	DB110.2 / 75391G09	gpm @	TDH	1	2004		Good
	Transfer Pump Motor #1	US Motors	001 F	2 HP	1,740 RPM	1	2004		Good
	Transfer Pump Motor #2	Emerson	69689E / NA	2 HP	3,450 RPM	1	2004		Good
Water Treatment Plant Chemical Feed Center at Ross Pump Station	Chemical Spill Holding Tanks								
	Storage Tank #1	Sii		4,000 Gal		1	2002		Good
	Storage Tank #2	Sii		4,000 Gal		1	2002		Good
	Storage Tank #3	Sii		4,000 Gal		1	2002		Good
	Phosphate Feed System								

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	Phosphate Solution Tank, PE flat bottom with removable lid			100 Gal	1	2002		Good
	Phosphate Solution Feed Pump	Wallace Tiernan	A116146	Gph @ 60 Psig	1			Good
	Phosphatel Solution Feed Pump Motor	GE	Model 5KHC39QN9581GT	1/3 HP @ 1,725 RPM	1			Good - Feeding Phosphate to Soda Ash System
	Phosphate Solution Tank Mixer	GE	Cat # C365	1/4 HP @ 1,725 RPM	1	2002		Out of Service, no shaft or blade
	Phosphate Solution Tank Level Indicator		Probe Type		1	2002		Good
	Chemical Solution Tank Level Indicator		Probe Type		1	2002		Good
	Ferric Chloride Feed System							
	Storage Bin #3	NA	NA	16000 Gal	1	1960		Good
	Storage Bin #5	NA	NA	16,000 Gal	1	1960		Good
	Storage Bin #6	NA	NA	16,000 Gal	1	1960		Good
	Feed Pump 1 - Dual head Metering	USFilter	R-100-7746/ 013GLH20430	gpm @ 'TDH	1	2004		Fair with external corrosion, newer pump head - Needs Replaced
	Feed Pump 2 - Dual head Metering	USFilter		gpm @ 'TDH	1	2004		Poor w/ external corrosion -Needs Replaced
	Feed Pump 3 - Dual head Metering	USFilter		gpm @ 'TDH	1	2004		Poor w/ external corrosion -Needs Replaced
	Feed Pump Motor 1	Baldor	SN - W0304120795	1 HP 1,750 RPM	1	2004		Poor w/ external corrosion -Needs Replaced
	Feed Pump Motor 2	Baldor	SN - W0344160750	1 HP 1,750 RPM	1	2004		Poor w/ external corrosion -Needs Replaced
	Feed Pump Motor 3	Baldor	SN - W0208160745	1 HP 1,750 RPM	1	2004		Poor w/ external corrosion -Needs Replaced
	#3 Level Indicator, cont. analog output	Bindicator Silomaster	NA		1	1994	16	Nonfunctional
	#5 Level Indicator, cont. analog output	Bindicator Silomaster	NA		1	1994	16	Nonfunctional
	#6 Level Indicator, cont. analog output	Bindicator Silomaster	NA		1	1994	16	Nonfunctional - Replaced
	#6 Level Indicator, LED Readout	Siemens	NA		1	2010	0	Excellent; Replaced above unit
	Lime Feed System							
	Storage Bin #1	NA	NA	150,000 LBs	1	1960		Good
	Storage Bin #2	NA	NA	150,000 LBs	1	1960		Good
	#1 Level Indicator, cont. analog output	Bindicator Silomaster	SN-CL3G1E204-30		1	1994	16	Nonfunctional
	#2 Level Indicator, cont. analog output	Bindicator Silomaster	SN-CL3G1E204-30		1	1994	16	Nonfunctional
	#1 Pressure Relief Valve	Groth Equip. Corp	10-1		1	1994		Good
	#2 Pressure Relief Valve	Groth Equip. Corp	10-2		1	1994		Good
	Dust Collector Unit #1	DCE Dalamatic			1	1994		Inspect & Evaluate
	Dust Collector Unit #2	DCE Dalamatic			1	1994		Inspect & Evaluate

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Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Dust Collector Motor #1	Baldor		7.5 HP RPM	1	1994		Good
	Dust Collector Motor #2	Baldor		7.5 HP RPM	1	1994		Good
	Dust Collector #1 Pres Dif Gauge	NA	NA		1	1994		Inspect & Evaluate
	Dust Collector #2 Pres Dif Gauge	NA	NA		1	1994		Inspect & Evaluate
	Volumetric Feeder #1 w/ gear reducer	US Filter	Series 32-300		1	2009		Good
	Volumetric Feeder #2 w/ gear reducer	US Filter	Series 32-300		1	2009		Good
	Motor - Volumetric Feeder #1	Baldor		1 HP 1,725 RPM	1	2009		Good
	Motor - Volumetric Feeder #2	Inverter		1 HP 1,725 RPM	1	2009		Good
	Lime Slaker #1	Siemens	BN19763/ 126438-SA1			2009		Good
	Lime Slaker #2	Siemens	BN19763/ 126438-SA1			2009		Good
	Vibrator Gauge	SWECO				2009		Good
	Vibrator Gauge	SWECO				2009		Good
	Potassium Permanganate Feed System							
	Storage Bin #9	NA	NA	150,000 LBs	1	1960		Good
	Level Indicator, cont. analog output	Bindicator Silomaster	SN-CL3G1E204-30		1	1994	16	Good
	Pressure Release Valve	Groth Equip. Corp	3		1			Good
	Dust Collector Unit	DCE Dalamatic			1	1994		Inspect & Evaluate
	Dust Collector Motor	Baldor		7.5 HP RPM	1	1994		Good
	Dust Collector Pres Dif Gauge	NA	NA		1	1994		Inspect & Evaluate
	Magnetic Vibrator	Bindicator Silomaster			1	1994		Good
	Solution Tank	Wallace Tiernan			1	2010		Good
	Solution Tank Mixer	Wallace Tiernan			1	1994		Good
	Solution Tank Mixer Motor	Wallace Tiernan		1/3 HP RPM	1	1994		Good
	Solution Tank Control Panel	Syntron	V-9 / W-7488	115 VAC		1994		Good
	Solution Feed Pump, Centrifugal			GPM @ TDH		2004		Fair
	Solution Feed Pump Motor, 480 V			3 HP RPM		2004		
	Polyelectrolyte Feed System							
	Storage Bin #8	NA	NA	16,000 GAL	1	1960		Good
	Level Indicator, cont. analog output	Bindacator Silomaster	SN-CL3G1E204-30		1	1994	16	Nonfuntional - Replaced
	Level Indicator, LED Readout	Siemens	NA			2010	0	Excellent - Replaced Above

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	Solution Feed Pump #1, Contrifugal	Pulsafeeder	1	6 GPH		1	2004		Good
	Solution Feed Pump #2, Contrifugal	Pulsafeeder	2	6 GPH		1	2004		Good
	Solution Feed Pump Motor #1, 480 V	Baldor	40C AMB Cont	0.17 HP	1,725 RPM	1	2004		Good
	Solution Feed Pump Motor #2, 480 V	Baldor	40C AMB Cont	0.17 HP	1,725 RPM	1	2004		Good
	Caustic Feed System								
	Storage Tank - Fiberglass	Augusta Fiberglass Inc.		5,250 Gal	8' dia 16' high	1	2004		Good
	Feed Pump No. 1 Metering	US Filter	Encore 700 / BF 45743	160 GPH	100 PSIG	1	2004		Poor with much external rust
	Feed Pump No. 2 Metering	US Filter	Encore 700 / BF 45742	160 GPH	100 PSIG	1	2004		Fair with external rust
	Feed Pump No. 1 Motor	Baldor	35G719T634 / F898	0.75 HP	1,725 RPM	1	2004		Fair with external rust
	Feed Pump No. 2 Motor	Baldor	35G719T634 / F396	0.75 HP	1,725 RPM	1	2004		Fair with external rust
	Soda Ash Feed System								
	Storage Bin #4	NA	NA	150,000	LBs	1	1960		Good
	Storage Bin #7	NA	NA	150,000	LBs	1	1960		Good
	#1 Level Indicator, cont. analog output	Bindicator Silomaster	SN-CL3G1E204-30			1	1994	16	Nonfunctional
	#2 Level Indicator, cont. analog output	Bindicator Silomaster	SN-CL3G1E204-30			1	1994	16	Nonfunctional
	#1 Pressure Release Valve	Groth Equip. Corp	10-1			1	1994		Good
	#2 Pressure Release Valve	Groth Equip. Corp	10-2			1	1994		Good
	Dust Collector Unit #1	DCE Dalamatic				1	1994		Inspect & Evaluate
	Dust Collector Unit #2	DCE Dalamatic				1	1994		Inspect & Evaluate
	Dust Collector Motor #1	Baldor		7.5 HP	RPM	1	1994		Good
	Dust Collector Motor #2	Baldor		7.5 HP	RPM	1	1994		Good
	Dust Collector #1 Pres Dif Gauge	NA	NA			1	1994		Inspect & Evaluate
	Dust Collector #2 Pres Dif Gauge	NA	NA			1	1994		Inspect & Evaluate
	Screw Feeder #1					1	1994		Good
	Screw Feeder #2					1	1994		Good
	Solution Tank #1					1	1994		Good
	Solution Tank #2					1	1994		Good
	Solution Tank #1 Mixer					1	1994		Good
	Solution Tank #2 Mixer					1	1994		Good
	Solution Tank #1 Mixer Motor	Century		1/3 HP	1,725 RPM	1	1994		Good

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	Solution Tank #2 Mixer Motor	Century		1/3 HP 1,725 RPM	1	1994		Good
	Control Panel EDP-1	Siemens			1	1994		Good
	Control Panel EDP-2	Siemens			1	1994		Good
	Solution Feed Pump @ Bin 4, 1x2-10	Peerless	10-A	30 GPM @ 70 TDH	1	2010		Good
	Solution Feed Pump At Bin 7, 1x2-10	Peerless	8196MTP/ 079158A	30 GPM @ 70 TDH	1	2011		Good
	Solution Feed Pump Motor @ Bin #4	Line	A	3 HP 1,740 RPM	1	2010		Good
	Solution Feed Pump Motor @ Bin #7	US Motor	W01V329R084M	3 HP 1,750 RPM	1	2011		Good
Water Filtration Plant Screen Room	Traveling Screens							
	Intake Screen 1 East - Auto Backwash	Siemens	45A TWS		1	2009		Excellent
	Intake Screen 2 West - Auto Backwash	Siemens	45A TWS		1	2009		Excellent
	Conveyor Discharge Screw	Jim Meyers & Sons	NA / 0840-SC10		1	2009		Excellent
	Discharge Screw Motor	SEW Eurodrive	DRE80H4DH-102	1 HP 1,740 RPM	1	2009		Excellent
	Rapid Flash Mixers							
	1 - Mixer	Lightnin	85C20/1000000058240	20 HP 55.5 RPM		2010		Excellent
	2 - Mixer	Lightnin	85C20/1000000058241	20 HP 55.5 RPM		2010		Excellent
	3 - Mixer	Lightnin	85C20/1000000058239	20 HP 55.5 RPM		2010		Excellent
	4 - Mixer	Lightnin	85C20/1000000058238	20 HP 55.5 RPM		2010		Excellent - Not Installed Yet
	4 - Mixer	Philadelphia	3809-S PTS	20 HP 56 RPM		1994		To Be Replaced with Above Unit
	1 - Mixer Motor	Baldor Reliance	S9018419-001 002 GL	20 HP 1,760 RPM		2010		Excellent
	2 - Mixer Motor	Baldor Reliance	S9018419-001 007 GL	20 HP 1,760 RPM		2010		Excellent
	3 - Mixer Motor	Baldor Reliance	S9000352-001 001 AL	20 HP 1,760 RPM		2010		Excellent
	4 - Mixer Motor	Baldor Reliance	S9018419-001 023 GL	20 HP 1,760 RPM		2010		Excellent - Not Installed Yet
	4 - Mixer Motor	Reliance	1XAF62220	20 HP 1,755 RPM		1994		To Be Replaced with Above Unit
	Carbon Feed System							
	Precarbon Transfer Pump #1	Peerless Pump Co.	8196 MTP / 079155B	100 gpm 50' TDH		1993		Poor - Needs Replaced
	Precarbon Transfer Pump #2	Peerless Pump Co.	8196 MTP / 079155A	100 gpm 50' TDH		1993		Poor - Needs Replaced
	Precarbon Pump Motor #1	US Motors	V09V203R018M	5 HP 1,740 RPM		1993		Poor - Needs Replaced
	Precarbon Pump Motor #2	US Motors	V09V203R018M	5 HP 1,740 RPM		1993		Poor - Needs Replaced

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	Carbon Slurry Recirculation Pump # 1	Goulds	3196 / A745F022-1	2 HP	1,800 RPM		2009		Good
	Carbon Slurry Recirculation Pump # 2	Sterling Pump Co.	8196-S / 07806B	2 HP	1,735 RPM				Out of Service - Replacement Purchased; Needs installed
	Carbon Slurry Recirculation Pump # 3	Sterling Fluid Systems	8196-S / 671405	2 HP	1,750 RPM		2008		Good
	Carbon Slurry Reciculation Pump Motor #1	Emerson	S425 / L08-S425-M	2 HP	1,735 RPM		2009		Good
	Carbon Slurry Recirculation Pump Motor #2	US Motors	NA / C0789U08U168R101F	2 HP	1,735 RPM				Out of Service - Replacement Purchased; Needs installed
	Carbon Slurry Recirculation Pump Motor #3	Emerson	S425 / H01-S425-M	2 HP	1,735 RPM		2008		Good
	Rotodip Carbon Feeder #1						1994		Poor: Not in Use
	Rotodip Carbon Feeder #2						1994		Poor: Not in Use
	Rotodip Carbon Feeder #3						1994		Poor
	Carbon Rotodip Premixer #1			HP @	RPM		1994		Not Operational
	Carbon Rotodip Premixer #2			HP @	RPM		1994		Not Operational
	Carbon Rotodip Premixer #3			HP @	RPM		1994		Not Operational
	Carbon Tank No. 1 Mixer	Philadelphia	91DGK0183	20 HP	56 RPM	1	1994		Good
	Carbon Tank No. 2 Mixer	Philadelphia	91DGK0182	20 HP	56 RPM	1	1994		Good
	Carbon Tank No. 3 Mixer	Philadelphia	84DEJ0326	20 HP	56 RPM	1	1994		Out of service with fallen impeller
	Carbon Tank No. 1 Mixer Motor	Reliance	3MAF62220	20 HP	1,740 RPM	1	1994		Good
	Carbon Tank No. 2 Mixer Motor	Reliance	C0901210117	20 HP	1,760 RPM	1	1994		Good
	Carbon Tank No. 3 Mixer Motor	Reliance	Y145109A3	20 HP	1,725 RPM	1	1994		Good
	Cabon Sump Pump								Fair
	Carbon Sump Pump Motor								Fair
Water Filtration Plant Clarifiers	Clarifier Basins					4	1960		Good
	1 - Sludge Collector A	Siemens					2011		Excellent
	1 - Sludge Collector B	Siemens					2011		Excellent
	1 - Sludge Collector C	Siemens					2011		Excellent
	1 - Sludge Collector D	Siemens					2011		Excellent
	1 - Sludge Collector Gear Reducer A/B	SEW Eurodrive					2011		Excellent
	1 - Sludge Collector Motor A/B	Baldor Reliance					2011		Excellent
	1 - Sludge Collector Gear Reducer C/D	SEW Eurodrive					2011		Excellent

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	1 - Sludge Collector Motor C/D	Baldor Reliance				2011		Excellent
	1 - Screw Auger	Siemens				2011		Excellent
	1 - Sludge Screw Auger Gear Reducer	SEW Eurodrive				2011		Excellent
	1 - Sludge Screw Auger Motor	Baldor Reliance				2011		Excellent
	1 - Flocculator Primary A	Envirex				1989		Poor - Needs Replaced
	1 - Flocculator Gear Reducer Primary A	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.003			2005		Good
	1 - Flocculator Motor Primary A	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.003	5 HP 1,800 RPM		2005		Good
	1 - Flocculator Secondary B	Envirex				1989		Poor - Needs Replaced
	1 - Flocculator Gear Reducer Secondary B	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.002			2005		Good
	1 - Flocculator Motor Secondary B	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.002	2 HP 1,800 RPM		2005		Good
	1 - Flocculator Primary C	Envirex				1989		Poor - Needs Replaced
	1 - Flocculator Gear Reducer Primary C	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.008			2005		Good
	1 - Flocculator Motor Primary C	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.008	5 HP 1,800 RPM		2005		Good
	1 - Flocculator Secondary D	Envirex				1989		Poor - Needs Replaced
	1 - Flocculator Gear Reducer Secondary D	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.001			2005		Good
	1 - Flocculator Motor Secondary D	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.001	2 HP 1,800 RPM		2005		Good
	2 - Sludge Collector A	Siemens				2011		Excellent
	2 - Sludge Collector B	Siemens				2011		Excellent
	2 - Sludge Collector C	Siemens				2011		Excellent
	2 - Sludge Collector D	Siemens				2011		Excellent
	2 - Sludge Collector Gear Reducer A/B	SEW Eurodrive				2011		Excellent
	2 - Sludge Collector Motor A/B	Baldor Reliance				2011		Excellent
	2 - Sludge Collector Gear Reducer C/D	SEW Eurodrive				2011		Excellent
	2 - Sludge Collector Motor C/D	Baldor Reliance				2011		Excellent
	2 - Screw Auger	Siemens				2011		Excellent
	2 - Sludge Screw Auger Gear Reducer	SEW Eurodrive				2011		Excellent
	2 - Sludge Screw Auger Motor	Baldor Reliance				2011		Excellent
	2 - Flocculator Primary A	Envirex				1989		Poor - Needs Replaced

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	2 - Flocculator Gear Reducer Primary A	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.005			2005		Good
	2 - Flocculator Motor Primary A	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.005	5 HP 1,800 RPM		2005		Good
	2 - Flocculator Secondary B	Envirex				1989		Poor - Needs Replaced
	2 - Flocculator Gear Reducer Secondary B	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.005			2005		Good
	2 - Flocculator Motor Secondary B	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.005	2 HP 1,800 RPM		2005		Good
	2 - Flocculator Primary C	Envirex				1989		Poor - Needs Replaced
	2 - Flocculator Gear Reducer Primary C	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.002			2005		Good
	2 - Flocculator Motor Primary C	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.002	5 HP 1,800 RPM		2005		Good
	2 - Flocculator Secondary D	Envirex				1989		Poor - Needs Replaced
	2 - Flocculator Gear Reducer Secondary D	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.001			2005		Good
	2 - Flocculator Motor Secondary D	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.001	2 HP 1,800 RPM		2005		Good
	3 - Sludge Collector A	Siemens				2010		Excellent
	3 - Sludge Collector B	Siemens				2010		Excellent
	3 - Sludge Collector C	Siemens				2010		Excellent
	3 - Sludge Collector D	Siemens				2010		Excellent
	3 - Sludge Collector Gear Reducer A/B	SEW Eurodrive	K77R37AM56-KS / 850269141.10.10.006			2010		Excellent
	3 - Sludge Collector Motor A/B	Baldor Reliance	34K066-081261	0.5 HP 1,800 RPM		2010		Excellent
	3 - Sludge Collector Gear Reducer C/D	SEW Eurodrive	K77R37AM56-KS / 850269141.10.10.005			2010		Excellent
	3 - Sludge Collector Motor C/D	Baldor Reliance	34K066-081261	0.5 HP 1,800 RPM		2010		Excellent
	3 - Screw Auger	Siemens				2010		Excellent
	3 - Sludge Screw Auger Gear Reducer	SEW Eurodrive	K97AM184-KS / 850269144.10.10.007			2010		Excellent
	3 - Sludge Screw Auger Motor	Baldor Reliance	CEM3165T / F1002111059	5 HP 1,750 RPM		2010		Excellent
	3 - Flocculator Primary A	Envirex				1989		Poor - Needs Replaced
	3 - Flocculator Gear Reducer Primary A	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.004			2005		Good
	3 - Flocculator Motor Primary A	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.004	5 HP 1,800 RPM		2005		Good

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	3 - Flocculator Secondary B	Envirex				1989		Poor - Needs Replaced
	3 - Flocculator Gear Reducer Secondary B	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.008			2005		Good
	3 - Flocculator Motor Secondary B	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.008	2 HP 1,800 RPM		2005		Good
	3 - Flocculator Drive Primary C	Envirex				1989		Poor - Needs Replaced
	3 - Flocculator Gear Reducer Primary C	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.001			2005		Good
	3 - Flocculator Motor Primary C	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.001	5 HP 1,800 RPM		2005		Good
	3 - Flocculator Secondary D	Envirex				1989		Poor - Needs Replaced
	3 - Flocculator Gear Reducer Secondary D	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.007			2005		Good
	3 - Flocculator Motor Secondary D	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.007	2 HP 1,800 RPM		2005		Good
	4 - Sludge Collector A	Siemens				2009		Excellent
	4 - Sludge Collector B	Siemens				2009		Excellent
	4 - Sludge Collector C	Siemens				2009		Excellent
	4 - Sludge Collector D	Siemens				2009		Excellent
	4 - Sludge Collector Gear Reducer A/B	SEW Eurodrive	K77R37AM56-KS / 850147789.09.08.002			2009		Excellent
	4 - Sludge Collector Motor A/B	Baldor Reliance	05E03W16	0.5 HP 1,800 RPM		2009		Excellent
	4 - Sludge Collector Gear Reducer C/D	SEW Eurodrive	K77R37AM56-KS / 850147789.09.08.001			2009		Excellent
	4 - Sludge Collector Motor C/D	Baldor Reliance	05E03W16	0.5 HP 1,800 RPM		2009		Excellent
	4 - Screw Auger	Siemens				2009		Excellent
	4 - Sludge Screw Auger Gear Drive	SEW Eurodrive	K97AM184-KS / 850204822.09.09.001			2009		Excellent
	4 - Sludge Screw Auger Motor	Baldor Reliance	CEM3165T/ 06F057W352	5 HP 1,750 RPM		2009		Excellent
	4 - Flocculator Primary A	Envirex				1989		Poor - Needs Replaced
	4 - Flocculator Gear Reducer Primary A	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.006			2005		Good
	4 - Flocculator Motor Primary A	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.006	5 HP 1,800 RPM		2005		Good
	4 - Flocculator Secondary B	Envirex				1989		Poor - Needs Replaced
	4 - Flocculator Gear Reducer Secondary B	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.003			2005		Good

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	4 - Flocculator Motor Secondary B	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.003	2 HP 1,800 RPM		2005		Good
	4 - Flocculator Drive Primary C	Envirex				1989		Poor - Needs Replaced
	4 - Flocculator Gear Reducer Primary C	SEW Eurodrive	R10707100L4-KS / 890106670.05.05.007			2005		Good
	4 - Flocculator Motor Primary C	SEW Eurodrive	DFT100L4-KS / 890106670.05.05.007	5 HP 1,800 RPM		2005		Good
	4 - Flocculator Secondary D	Envirex				1989		Poor - Needs Replaced
	4 - Flocculator Gear Reducer Secondary D	SEW Eurodrive	R87DT90L4-KS / 890106667.05.05.004			2005		Good
	4 - Flocculator Motor Secondary D	SEW Eurodrive	DFT90L4-KS / 89010667.05.05.004	2 HP 1,800 RPM		2005		Good
Water Filtration Plant Sedimentation Basins	Sedimentation Basins				3	1906		
Water Filtration Plant	OPS Building							
Water Filtration Plant Filter Building	Rapid Sand Filters - Filter Building				18	1964		To Be Rehabilitated
	Control Panels	Leopold	SY/MAX		18	1990		Good
	Turbidity Sample Pump, Horiz Cent	Crane-Deming	Type A-1/ SN 186		1			Some external deterioration
	Turbidity Sample Pump Motor	Baldor		1/3 HP @ 3,450 RPM	1			Some external deterioration
	Backwash Vertical Pump	Johnson	Repair #-95JK8311/ JZ2732	GPM @ TDH	1	1995		To Be Rebuilt
	Backwash Vertical Pump Motor	Gen'l Dynamics	SN-80100771A1	300 HP @ 590 RPM	1	1995		Good
	Spare Backwash Pump	Johnson			1			Good
	Air Scour Blower No. 1	Hoffman			1	1990		To Be Replaced
	Air Scour Blower No. 1 Motor				1	1990		To Be Replaced
	Air Scour Blower No. 2	Hoffman			1	1990		To Be Replaced
	Air Scour Blower No. 2 Motor				1	1990		To Be Replaced
	Valves and Sluice Gates							

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	36" Influent Butterfly				18	1990		To Be Replaced or Rebuilt
	24" Effluent Butterfly				18	1964		To Be Replaced or Rebuilt
	30" Main Backwash Butterfly				18	1964		To Be Replaced or Rebuilt
	42" Filter Drain Butterfly				18	1990		To Be Replaced or Rebuilt
	12" Filter Air Inlet Butterfly				36	1990		To Be Replaced or Rebuilt
	12" Air Scour Flow Control				1	1990		To Be Replaced or Rebuilt
	30" Backwash Control Valve with double action Actuator	Pratt	Mod XR/ S034874-1		1	1998		To Be Replaced or Rebuilt
	30" Left or Right Backwash				36	1964		To Be Replaced or Rebuilt
	12" Motorized Inlet Control				2	1990		To Be Replaced or Rebuilt
	8" Rewash Butterfly				18	1990		To Be Replaced or Rebuilt
	Pre-Filter Chlorination Sodium Hypochlorite - North Garage of Filter Building							
	Hypochlorite Storage Tank #1	Nalgene	51309-1100 / 3A970038	1100 Gal	1			Good
	Hypochlorite Storage Tank #2	Nalgene	51309-1100 / 3A970039	1100 Gal	1			Good
	Hypochlorite Storage Tank #3		170708812	1000 Gal	1			Good
	Hypochlorite Storage Tank #4		170708840	1000 Gal	1			Good
	Hypochlorite Storage Tank #5	Ace Roto-Mold	VT00210SWSX	210 Gal	1			Good
	Pre-Chlorine Feed Pump #1	Prominent Sigma	OUD000C / 2706014201	28.5 GPH @ 145 PSI	1			Good
	Pre-Chlorine Feed Pump #2	Prominent Sigma	OUD000C / 2706003380	28.5 GPH @ 145 PSI	1			Good
	Pre-Filter Chlorination - Injection System Second Floor Filter Gallery							
	Day Tank, 4' dia x 4' high, PE			200 Gal	1			Good
	Pre-Chlorine Application Pump Peristaltic type	Cole-Palmer	Mod 7518-00		1			Good
	ORP Probe	Drexelbrook	800		1			Some external deterioration
	48" Air Circulation Fan - Portable	Dayton	3C673A	3/4 HP 2 Speed	1			Good
	Post-Filter Chlorination - North Garage of Filter Builing							
	Hypochlorite Storage Tank #1		170708826	1000 Gal	1			Good

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Hypochlorite Storage Tank #2		170708819	1000 Gal	1			Good
	Hypochlorite Storage Tank #3		170708801	1000 Gal	1			Good
	Hypochlorite Storage Tank #4		170708808	1000 Gal	1			Good
	Hypochlorite Storage Tank #5		170708794	1000 Gal	1			Good
	Hypochlorite Storage Tank #6		170708833	1000 Gal	1			Good
	Post-Chlorine Feed Pump	Prominent Sigma	OUDC000C /	96.5 GPH @ 58 PSI	1			Good
Water Filtration Plant Clearwell	Clearwell, Concrete UG Structure			44.50 MG	1	1912		Needs Renovated
	Inlet Gate House					1912		
	Sluice Gate Valve #1	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #1 Motor					1912		Fair
	Sluice Gate Valve #2	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #2 Motor					1912		Fair
	Sluice Gate Valve #3	Hydrogate			1	1912		Good
	Sluice Gate Valve #3 Motor		EIM Controls	2 HP @ 1,725 RPM	1	1912		Good
	Outlet Gate House					1912		
	Sluice Gate Valve #1	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #1 Motor					1912		Fair
	Sluice Gate Valve #2	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #2 Motor					1912		Fair
	Sluice Gate Valve #3	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #3 Motor					1912		Fair
	Sluice Gate Valve #4	Coffin Valve Co.			1	1912		Fair
	Sluice Gate Valve #4 Motor					1912		Fair
Water Filtration Plant Fluoride Feed System	Hydrofluorosilicic Acid Storage Tank #1	Edwards Fiberglass, Inc		7760 GAL	1	1991		Good
	Hydrofluorosilicic Acid Storage Tank #2	Edwards Fiberglass, Inc		7760 GAL	1	1991		Good
	HFA Feed Pump #1	Prominent Sigma			1			Uninstalled
	HFA Feed Pump #2	Prominent Sigma	SN 270708812	28.5 GPH @ 145 PSI	1	2009		Good

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity	Number of Units	Date Installed	Age of Unit	General Condition
	Air Compressor Motor	Speedaire	4B247B	3 HP 2900 3,500 RPM	1			Good
	Air Compressor Receiver	Speedaire	4B237C	30 Gal	1			Good
Chlorine Booster Stations (CBS)							6	
Brashear CBS	2 - 100 gal tanks, 2 - feed pumps			0.37 GPH	2	2004	6	Good
Bedford CBS	2 - 100 gal tanks, 2 - feed pumps			0.37 GPH	2	2004	6	Good
Garfield CBS	Deleted							Eliminated
Herron Hill CBS	3 - 100 gal tanks, 3 - feed pumps			0.55 GPH	3	2004	6	Good
Highland No. 2 CBS	6 - 160 gal tanks, 2 - feed pumps			13 GPH	2	2004	6	Good
Lanpher CBS	5 - 160 gal tanks, 2 - feed pumps			13 GPH	2	2004	6	Good
McNaugher CBS	2 - 100 gal tanks, 2 - feed pumps			0.37 GPH	2	2004	6	Good
Lincoln CBS	2 - 100 gal tanks, 2 - feed pumps			GPH	2	2009	1	Pump Being Replaced
Squirrel Hill CBS	2 - 100 gal tanks, 2 - feed pumps			GPH	22	2009	1	Good
Allentown CBS	2 - 100 gal tanks, 2 - feed pumps			GPH	2	2009	1	Pump Being Replaced
Rogers Sewage Pump Station	Pump #1 - Vacuum Primed Centrifugal	Smith & Loveless	14132-XX2983/ 841306A-1	1,000 gpm @ 95 TDH	1	1983	27	Pump and Motor Being Replaced
	Pump #2 - Vacuum Primed Centrifugal	Smith & Loveless	146561-2XX3103/ 833801B-1	1,000 gpm @ 95 TDH	1	1983	27	Pump and Motor Being Replaced
	Motor #1		66-1040	40 HP 1,800 RPM	1	1983	27	
	Motor #2		66-1040	40 HP 1,800 RPM		1983	27	
Lincoln Place (Mifflin Road) Sewage PS	Pump #1 - Vacuum Primed Centrifugal	Smith & Loveless	14656-XX3103/ 834442B-5	500 gpm @ 88 TDH	1	1983	27	Pump and Motor Being Replaced

Pittsburgh Water and Sewer Authority 40-Year Capital Plan
Major Pump and Equipment Inventory

Facility Name	Equipment Name - Brief Description	Equipment Manufacturer	Model No. / Serial No.	Capacity		Number of Units	Date Installed	Age of Unit	General Condition
	Pump #2 - Vacuum Primed Centrifugal	Smith & Loveless	146561-2-XX3103/ 834787B-8	500 gpm @	88 TDH	1	1983	27	Pump and Motor Being Replaced
	Motor #1		66-1039	20 HP	1,800 RPM	1	1983	27	
	Motor #2		66-1039	20 HP	1,800 RPM		1983	27	
Browns Hill Sewage PS	Pump #1 - Vacuum Primed Centrifugal	Smith & Loveless	13861-XX2979/ 832787B-5	250 gpm @	TDH	1	1983	27	Pump and Motor Being Replaced
	Pump #2 - Vacuum Primed Centrifugal	Smith & Loveless	13861-XX2978/ 8322955B-4	250 gpm @	TDH	1	1983	27	Pump and Motor Being Replaced
	Motor #1			10 HP	1,800 RPM	1	1983	27	
	Motor #2			10 HP	1,800 RPM		1983	27	
Evergreen Road Sewage PS	Pump #1 - Vacuum Primed Centrifugal	Smith & Loveless	16055-XX2980/ 63596C-1	150 gpm @	90 TDH	1	1983	27	Pump and Motor Being Replaced
	Pump #2 - Vacuum Primed Centrifugal	Smith & Loveless	16055-XX2980/ 835986C-26	150 gpm @	90 TDH	1	1983	27	Pump and Motor Being Replaced
	Motor #1		66-1041	15 HP	RPM	1	1983	27	
	Motor #2		66-1041	15 HP	RPM		1983	27	

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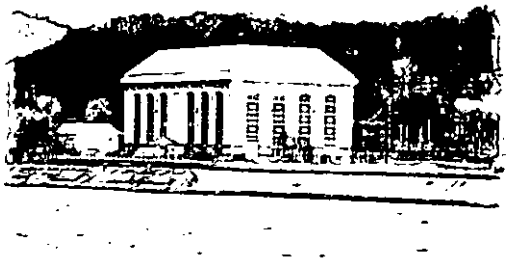



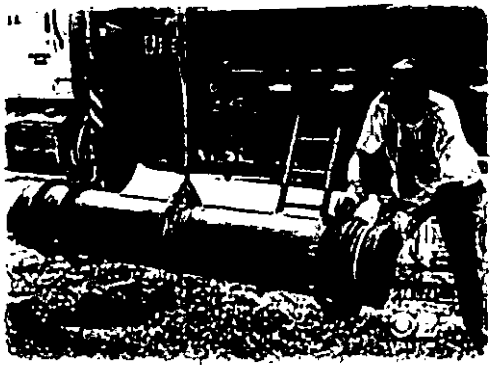



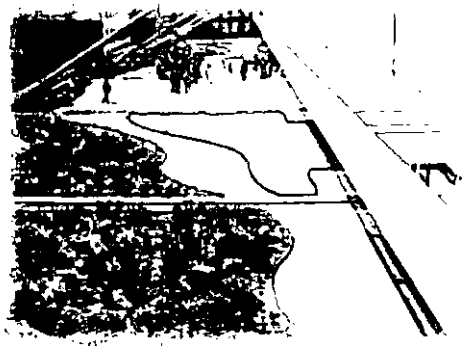

Pittsburgh Water and Sewer Authority

2017-2021 Capital Improvement Program (CIP)

Version: January 27, 2017- APPROVED

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Introduction

In February 1984, the City of Pittsburgh (City) established The Pittsburgh Water and Sewer Authority (PWSA) under the provisions of the Commonwealth of Pennsylvania. The City charged the PWSA with the responsibility of carrying out a major Capital Improvements Program (CIP) designed to refurbish the infrastructure of the entire water system, including the water treatment plant and distribution system. This project was to ensure that the water system met the rapidly expanding water quality requirements of the federal and state Safe Drinking Water Acts.

In 1995, PWSA also became responsible for producing and supplying the water for City of Pittsburgh residents and maintaining and operating the water distribution system. Then, in 1999 PWSA became responsible for operating and maintaining the entire City of Pittsburgh sewer system.

Today, PWSA provides quality water and quality services to approximately 83,000 customers throughout the City of Pittsburgh. PWSA operates and maintains a 117 million gallons per day (MGD) rapid sand type treatment plant, a 26 MGD microfiltration plant, approximately 1,000 miles of water mains, over 25,000 valves and 7,400 fire hydrants, 1 raw water pump station, 10 finished water pump stations, 4 in-ground reservoirs, 13 storage tanks (2 of which are above-ground reservoirs), approximately 1,220 miles of sanitary, storm, and combined sewers, 29,000 manholes, 27,000 catch basins and inlets, 38 Combined Sewer Overflow (CSO) outfalls, 185 storm outfalls, and four wastewater pump stations.

PWSA's vision is to provide water and wastewater services that meet or exceed regulations and customer expectations at the lowest possible cost.

Capital Improvement Program

Overview

PWSA's Capital Improvement Program focuses on sustaining cost-effective operations, while optimizing the system's asset performance and life expectancy. The 2017-2021 Capital Improvement Program invests in programs which consider risk and consequence of asset failure and levels of service benefits.

Development and Approval Process

PWSA's CIP process begins each year 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 predefined scoring system 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 options, risks, schedule, and the development of a preliminary cost estimate. This process lasts several months and culminates with the presentation of the updated CIP to PWSA's Board of Directors.

Projects that are not selected for execution at any stage will be re-assessed during the next year's CIP development process.

Capital Project Prioritization

Due to funding limitations and the need to renew/replacing a significant amount of aging infrastructure, the following criteria are used to evaluate and prioritize capital projects:

- Safety - Potential health and safety risks to personnel and the public if action is not taken
- Regulatory Compliance – Regulatory compliance schedule and potential fines for non-compliance
- Reliability/Operational Flexibility – Location, age, and condition of infrastructure and risk if action is not taken
- Capacity – Meets community health needs and growth, as needed
- Operations and Maintenance Efficiency – Potential for operating cost savings
- Regional Cooperation/Stewardship – Coordination with external stakeholders or meeting the communities needs
- Level of Service – Improvement to customer service
- Sustainability – Energy efficiency and "green" approach to improving water quality

Funding Sources

The PWSA Capital Improvement Program is funded through several primary sources to which specific programs and projects are allocated. These funding sources include, but are not limited to, PWSA Future Capital Bond Authorizations, cost shares with other utilities, and grants. PWSA is dedicated to identifying and pursuing funding from all potential sources to offset planned capital investments.

Capital Improvement Plan Organization

The CIP is organized into seven project classes (types):

- Water Treatment Plant
- Water Pumping and Storage
- Water Distribution System, which includes lead service line replacements
- Wastewater System
- Stormwater System
- Green Infrastructure
- Miscellaneous

Each project class is then made up of individual projects. Projects are defined based upon current information, which range from annual allowances for asset renewal and/or replacement activities, to major, multiple phase facility renewal projects.

The following information is provided for each project:

Project Class – Type of project.

Project Name – Descriptive name assigned to the project.

Project No. – Unique number assigned to track the project from inception to completion. This number is established once a project is approved.

Neighborhood/Ward – Project location(s) based on the City of Pittsburgh's Geographical Information System (GIS).

Status – Phase in the project life-cycle (i.e. assessment/design/construction).

Priority – Criteria utilized to prioritize the project.

Project Description - A basic understanding of the project's intent and scope of work.

Project Justification - A detailed explanation to why the project is needed.

Risk(s) - Outlines the risk(s) to PWSA if the project is delayed or is not selected.

Impact on Operations – Describes the anticipated impact to PWSA's operations when the project is completed.

Alternatives to the Recommended Action – Lists the alternatives that were considered or evaluated.

Funding Source(s) – Proposed funding source(s) for the project.

Commitment Schedule – Preliminary award schedule for the project in thousands of dollars.

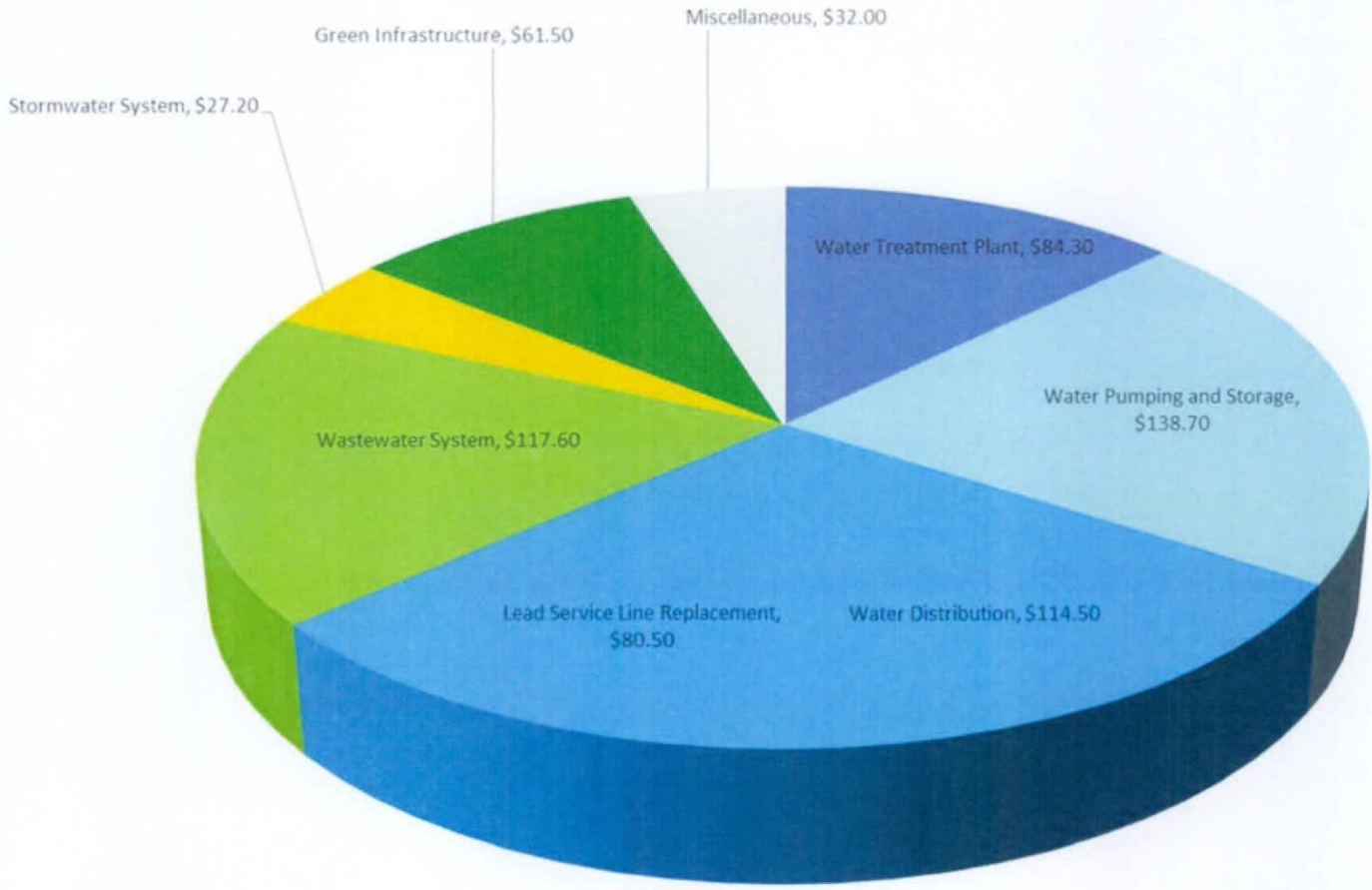
Cash Flow Summary – Preliminary cash flow for the project in thousands of dollars.

Note: Costs shown are concept level costs, including contingencies, and are based on previous reports, CIPs, or similar type projects, and are subject to change as the projects are more completely assessed through the project phases. Construction costs shown are escalated from the estimated midpoint of construction, at 3% per year, and include allowances for construction management and inspection and design services during construction. Design costs shown are based on pre-defined percentages based on the estimated construction cost.

2017 to 2021 Capital Improvement Program Summary

The charts below illustrate the proposed breakdown of the project classes and yearly cash flows for the 2017 to 2021 CIP. Costs shown are in Millions.

2017-2021 Proposed Capital Cash Flow by Project Class



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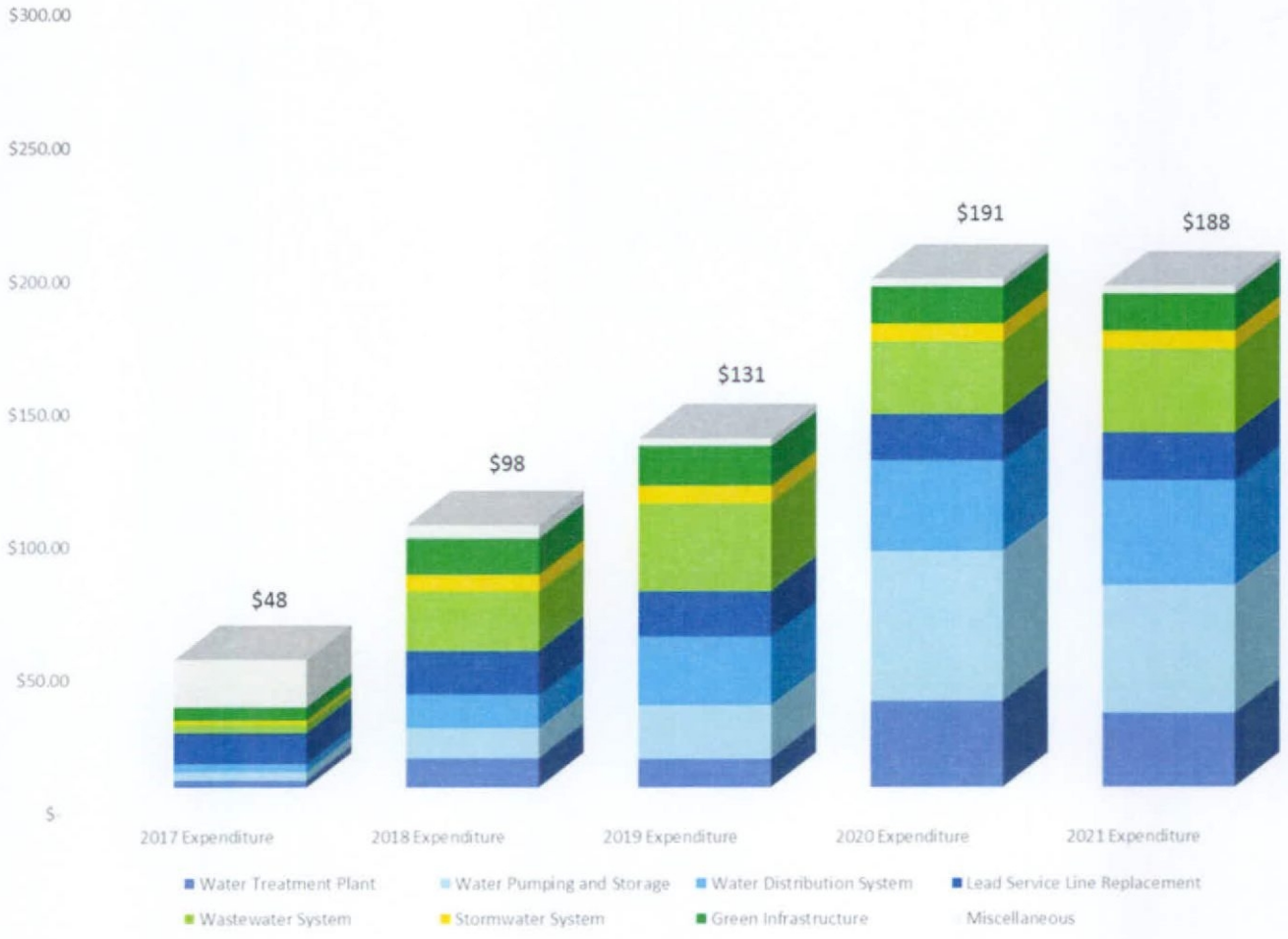
Proposed Yearly Capital Cash Flow by Project Class



FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Treatment Plant
PROJECT NAME Aspinwall Water Treatment Plant Utility Water Piping Improvements
PROJECT NO. Unassigned

STATUS Design

PRIORITY Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of the utility water systems in the Screen Room, Ross Pump Station, and Chemical Building.

PROJECT JUSTIFICATION
Numerous pipe failures have occurred due to corrosion. Additionally, many of the isolation valves in the piping system are only marginally functional and do not provide a tight shut-off. Failure of this system prevents chemical addition. Additionally, the utility water system is not properly isolated from the potable water system through the use of backflow preventers, which present safety hazards to staff.

RISK(S)
An unscheduled/unplanned interruption in the supply of service water due to pipe failure(s).

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	0	120						120
Construction		600						600
Total Project Cost	**0**	**720**	**0**	**0**	**0**	**0**	**0**	**720**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**120**	**600**	**0**	**0**	**0**	**0**	**720**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

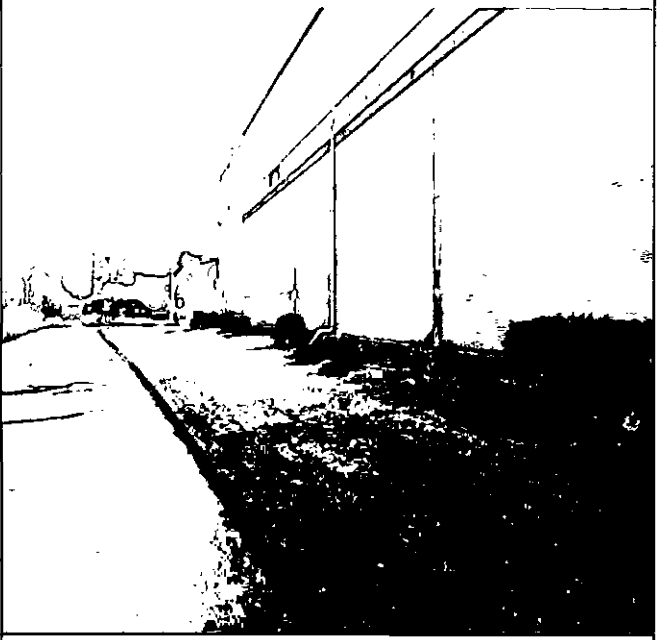
**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Clarifier and Solids Handling Improvements
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Reliability/Operational Flexibility

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Improvements to clarifiers, sedimenation, and associated systems, including evaluating process conditions to optimize treatment.

PROJECT JUSTIFICATION
Existing clarifiers do not operate as intended due to equipment and process issues. Addressing these will improve system operation, effciency, and solids handling/sludge removal.

RISK(S)
The buildup of solids and sludge in the clarifiers and sedimentation basins impact treatment capacity. The clarifier building will continue to be subject to further degradation and the roadway utilized for chemical delivery may not be navigable during winter months. Leakage may undermine the structural support of the building.

IMPACT ON OPERATIONS
Completed project will increase operating effectiveness by increasing safety for staff, restoring integrity to the building structure, providing reliable delivery truck access to the chemical feed area during the winter months, and flexibility of clarifier operation, and improve solids handling and sludge disposal.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	0	3,410						3,410
Construction		1,060		19,830				20,890
Total Project Cost	**0**	**4,470**	**0**	**19,830**	**0**	**0**	**0**	**24,300**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**1,100**	**2,710**	**2,550**	**7,560**	**7,560**	**2,820**	**24,300**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Pretreatment System Chemical Improvements
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Operations and Maintenance Efficiency

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Improvements to pretreatment chemical systems to provide improved water treatment capabilities.

PROJECT JUSTIFICATION
Chemical treatment systems are a critical component to producing safe drinking water. Components of the chemical treatment systems can no longer be operated in a safe, effective, or reliable manner to meet water quality requirements. Many bulk water treatment chemicals present safety hazards to staff. The storage and pumping systems associated with these chemicals have reached the end of their useful life. Failures resulting in dust creation and chemical spills can place operators in unsafe working conditions and can cause physical damage to equipment and structures, as well as environmental contamination.

RISK(S)
Inefficient operation of chemical systems result in increased operating costs, including chemical consumption, labor, solids generation and disposal, and wear on equipment. Failure of a chemical system poses a significant health and safety risk to personnel as well as an increased risk to water quality compliance.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, reliability, and life expectancy and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

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Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		545						545
Construction		2,805						2,805
Total Project Cost	**0**	**3,350**	**0**	**0**	**0**	**0**	**0**	**3,350**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**530**	**2,820**	**0**	**0**	**0**	**0**	**3,350**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

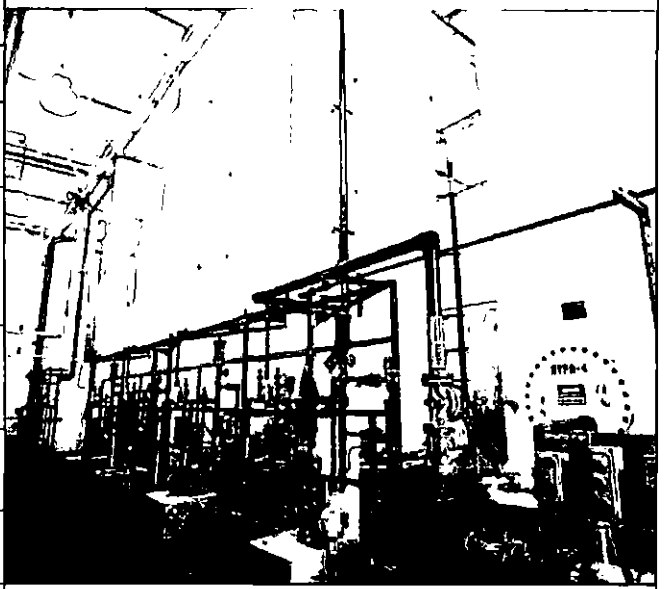
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Aspinwall Water Treatment Plant Fiberglass Reinforced Plastic Chemical Tank Inspections and Rehabilitation/Replacement
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Reliability/Operational Flexibility

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Inspection and rehabilitation and/or replacement of the fiberglass reinforced plastic chemical tanks.

PROJECT JUSTIFICATION
Existing tanks are near to a condition in which a catastrophic failure can occur without notice. Sodium Hypochlorite Tank No. 2 is currently out of service due to active leaks and needs to be relined. Without a backup tank, disruption to delivery will quickly impact the ability to provide regulatory-required disinfection.

RISK(S)
Failure of a chemical storage tank poses a significant health and safety risk to personnel as well as an increased risk to water quality compliance.

IMPACT ON OPERATIONS
Increased system reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
The plant design requires chlorine to be available. There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		25						25
Construction		68						68
Total Project Cost	**0**	**93**	**0**	**0**	**0**	**0**	**0**	**93**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**60**	**33**	**0**	**0**	**0**	**0**	**93**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Aspinwall Water Treatment Plant Calcium Hypochlorite Storage
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Procurement of a storage building for calcium hypochlorite.

PROJECT JUSTIFICATION
Calcium hypochlorite are solid tablets which can be used for disinfection of pipes and tanks. A supply of these tablets is maintained to provide planned and emergency disinfection of water storage facilities associated with water production. Currently these tablets are stored in an existing garage which does not meet the safety standards for this chemical. Storage of the tablets in this garage has also deteriorated the building.

RISK(S)
Without a supply of calcium hypochlorite available, emergency disinfection of water storage facilities cannot occur, impacting water quality and production.

IMPACT ON OPERATIONS
Improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
A custom storage room could be designed within an existing area of the water plant. This will likely be at a higher cost to meet fire and building codes for storage and to integrate into an existing structure.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		18						18
Construction		105						105
Total Project Cost	**0**	**123**	**0**	**0**	**0**	**0**	**0**	**123**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**115**	**8**	**0**	**0**	**0**	**0**	**123**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Aspinwall Water Treatment Plant Electrical and Backup Power Improvements
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Operations and Maintenance Efficiency

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Improvements to electrical systems at Aspinwall Water Treatment Plant (WTP), including provisions for stand-by or backup power systems, upgrades to existing electrical distribution system, replacement of motor control centers, and associated panels, conduit, wiring, and systems.

PROJECT JUSTIFICATION
Electrical systems at the WTP have generally met the end of their useful lives and spare/replacement parts are unavailable. Electrical panels do not meet current safety standards, including lack of arc flash protection. Additionally, the WTP does not have redundant power systems or a means for stand-by power for critical pumping and treatment systems.

RISK(S)
Electrical power is critical to maintain pumping and treatment of water. Failure of these systems will result in the inability to produce water to meet demand and/or quality requirements.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								
Design		2,970						2,970
Construction				23,350				23,350
Total Project Cost	**0**	**2,970**	**0**	**23,350**	**0**	**0**	**0**	**26,320**

CASH FLOW SUMMARY (000's)

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**540**	**1,810**	**2,940**	**8,870**	**8,860**	**3,300**	**26,320**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Clearwell Demolition
PROJECT NO.	Unassigned
STATUS	Not Started
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Demolition of the existing 108 year old clearwell (finished water structure).

PROJECT JUSTIFICATION
The clearwell was constructed in 1908 and has not undergone any major modifications or upgrades since. The entire plant must be shutdown to inspect and perform maintenance of the clearwell. It has two main functions: providing equalization storage that allows the filters to operate independently of potential fluctuations in system demands and providing sufficient retention contact time for disinfection agents to meet the requirements of the Surface Water Treatment Rule and Long-Term 2 Enhanced Surface Water Treatment Rule. Considering age and condition of the clearwell, it is the water system's weakest link as there are no practical means to deliver water by bypassing the clearwell, while maintaining the required volume, quality, and contact time.

RISK(S)
Clearwell failure will cease all water delivery to all the Authority's customers (residential, commercial, industrial, institutional, bulk rate customers, public health and safety providers, fire protection, governmental facilities, other water distributors, etc.), creating a public health emergency.

IMPACT ON OPERATIONS
Ability to meet system reliability and water quality regulations.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action as the clearwell is an essential element of the water distribution system.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design							1,570	1,570
Construction							10,780	10,780
Total Project Cost	**0**	**0**	**0**	**0**	**0**	**0**	**12,350**	**12,350**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**0**	**0**	**12,350**	**12,350**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Treatment Plant
PROJECT NAME Clearwell Emergency Response Project
PROJECT NO. 2013-930-231-0

NEIGHBORHOOD/WARD
Systemwide

STATUS Design

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service



PROJECT DESCRIPTION
Installation of two pump suction wet wells at Aspinwall and Bruecken Pump Stations and associated piping and appurtenances to bypass the existing clearwell.

PROJECT JUSTIFICATION
This project will provide a means to bypass the existing clearwell. Note: Disinfection requirements will not be achieved while bypassing is occuring. Additionally, this infrastructure will be required to maintain water supply to PWSA's customers for the rehabilitation or replacement of the existing clearwell.

RISK(S)
Clearwell failure will cease all water delivery to all the Authority's customers (residential, commercial, industrial, institutional, bulk rate customers, public health and safety providers, fire protection, governmental facilities, other water distributors, etc.), creating a public health emergency.

IMPACT ON OPERATIONS
Ability to meet system reliability and water quality regulations.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action as the clearwell is an essential element of the water distribution system.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	170							170
Design		3,060						3,060
Construction				24,570				24,570
Total Project Cost	**170**	**3,060**	**0**	**24,570**	**0**	**0**	**0**	**27,800**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**170**	**440**	**1,790**	**3,290**	**13,960**	**8,150**	**0**	**27,800**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

* Concept level costs based on previous reports, minus improvements to Aspinwall P.S., Bruecken P.S., Highland Reservoir P.S. and Rising Main, and Aspinwall Pump Station to Lanpher Reservoir Rising Main.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Clearwell Improvements
PROJECT NO.	Unassigned
STATUS	Not Started
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of the existing 108 year old clearwell (finished water structure).

PROJECT JUSTIFICATION
The clearwell was constructed in 1908 and has not undergone any major modifications or upgrades since. It has two main functions: providing equalization storage that allows the filters to operate independently of potential fluctuations in system demands and providing sufficient retention contact time for disinfection agents to meet the requirements of the Surface Water Treatment Rule and Long-Term 2 Enhanced Surface Water Treatment Rule. Considering the age and condition of the clearwell, it is the water system's weakest link as there are no practical means to deliver water by bypassing the clearwell, while maintaining the required volume, quality, and contact time.

RISK(S)
Clearwell failure will cease all water delivery to all the Authority's customers (residential, commercial, industrial, institutional, bulk rate customers, public health and safety providers, fire protection, governmental facilities, other water distributors, etc.), creating a public health emergency.

IMPACT ON OPERATIONS
Ability to meet system reliability and water quality regulations.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action as the clearwell is an essential element of the water distribution system.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design					4,400			4,400
Construction							35,290	35,290
Total Project Cost	**0**	**0**	**0**	**0**	**4,400**	**0**	**35,290**	**39,690**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**755**	**2,495**	**36,440**	**39,690**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

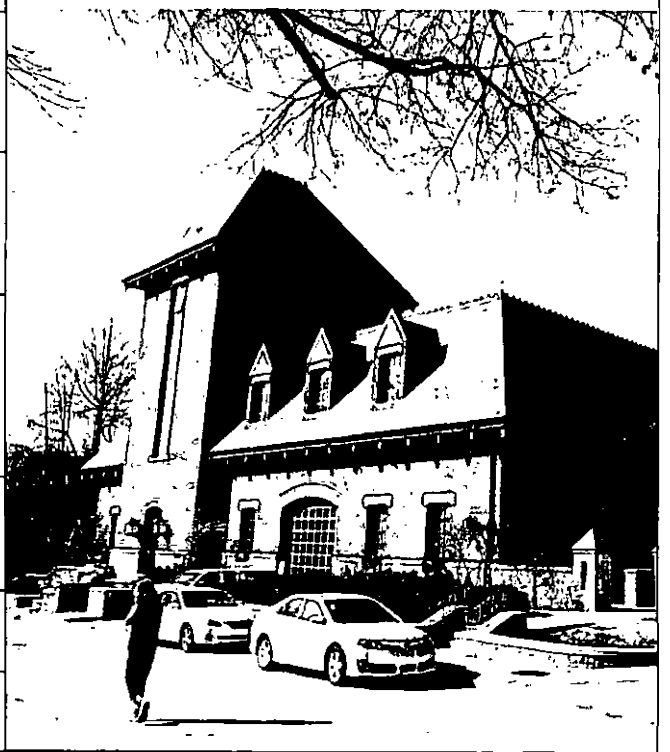
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant		
PROJECT NAME	Highland Park Membrane Filtration Plant Assessment and Critical Process Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Complete a condition assessment of systems supporting the treatment process and perform critical improvements to maintain water treatment and allow full warranty of replacement modules. Improvements may include electrical, chemical feed, strainers, and other support systems.

PROJECT JUSTIFICATION
Membrane module failure rate has continually increased over the last several years and are more than 5 years beyond the manufacturer's recommended replacement cycle. To allow module membrane manufacturers to extend a full warranty, a system condition assessment is needed. A detailed condition assessment is needed to address other critical worker safety and degradation of equipment that are essential to maintain the water treatment process.

RISK(S)
Exposes the Authority to higher costs to address emergency failures and exposes the Highland No. 1 Service Area to a potentially deficient or non-complaint water supply.

IMPACT ON OPERATIONS
Increase operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Provide covered system storage for the Highland No. 1 Service Area and eliminate the microfiltration plant.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study		10						10
Design		130						130
Construction			845					845
Total Project Cost	**0**	**140**	**845**	**0**	**0**	**0**	**0**	**985**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**80**	**855**	**50**	**0**	**0**	**0**	**985**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

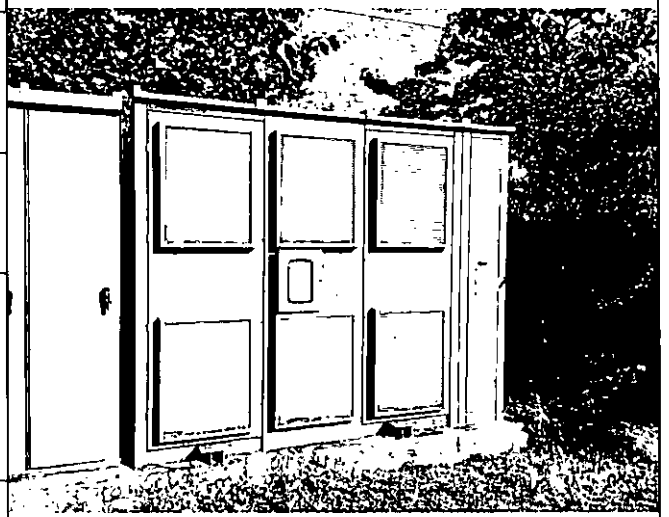
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Treatment Plant
PROJECT NAME Highland Park Membrane Filtration Plant Transformer Repair and UPS Replacement
PROJECT NO. Unassigned

STATUS Design

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of a failed cooling fan on the electrical transformer supplying all power to the Membrane Filtration Plant (MFP) and replacement of the 2nd Floor UPS providing backup power to process controls.

PROJECT JUSTIFICATION
The Authority owns the electrical transformer supplying power to the MFP. The transfomer includes three cooling fans which permit continued operation during summer months, but one of these fans has failed and requires replacement to ensure continuous facility power. The UPS on the 2nd floor needs to be replaced to provide continuous backup power to process control panels on the 2nd floor. The existing UPS has not been under warranty since 2011 and a similar UPS failed in 2016, at which time it was replaced.

RISK(S)
Loss of electrical power to the MFP will result in loss of water service to the Highland Reservoir No. 1 service area.

IMPACT ON OPERATIONS
Provides electrical power to facility to allow continual water treatment.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		10						10
Construction		61						61
Total Project Cost	**0**	**71**	**0**	**0**	**0**	**0**	**0**	**71**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**71**	**0**	**0**	**0**	**0**	**0**	**71**

FUNDING SOURCE(S)

☒ Capital
☐ Expense: ☐ Engineering ☐ Sewer ☐ Water
☐ Cost Share
☐ Other

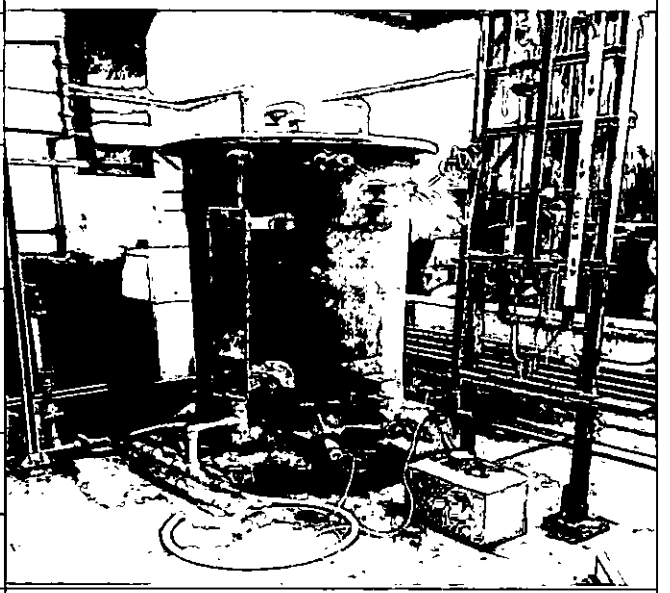
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Highland Park Membrane Filtration Plant Fiberglass Reinforced Plastic Chemical Tank Inspections and Rehabilitation/Replacement
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Reliability/Operational Flexibility

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Inspection and rehabilitation and/or replacement of the fiberglass reinforced plastic chemical tanks.

PROJECT JUSTIFICATION
Based on the age, service, and visual observations of the tanks ,rehabilitation is needed to maintain the integrity of the tanks. Known repairs include the replacement of the 300 gallon sodium hypochlorite day tank and repair/modification of the vent piping on the caustic tank.

RISK(S)
Failure of a chemical storage tank poses a significant health and safety risk to personnel. Exposes the Authority and the Highland No. 1 Service Area to a potentially deficient or non-complaint water supply, where emergency/unplanned repairs will typically add 30 to 50% to the capital expenses required.

IMPACT ON OPERATIONS
Increased flexibility and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	0	18						18
Construction		51						51
Total Project Cost	**0**	**69**	**0**	**0**	**0**	**0**	**0**	**69**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**40**	**29**	**0**	**0**	**0**	**0**	**69**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

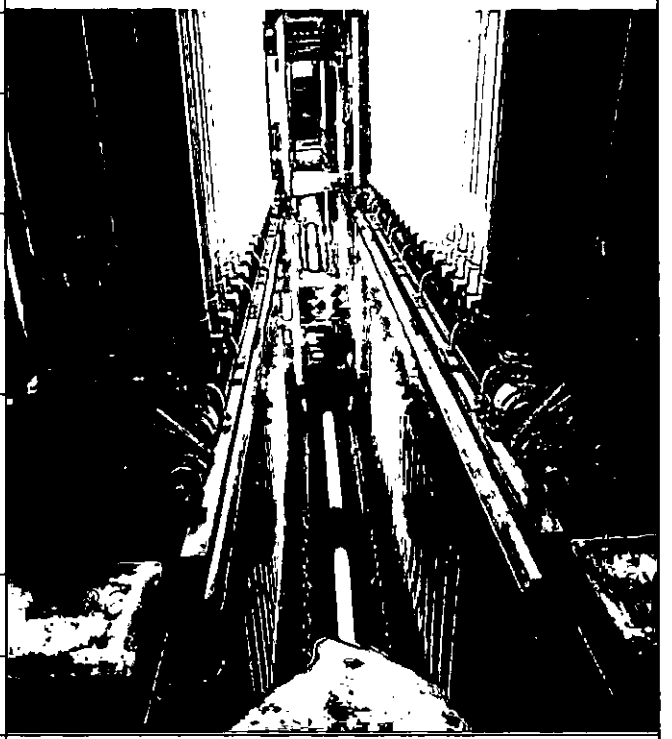
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Treatment Plant
PROJECT NAME Highland Park Membrane Filtration Floor Drainage Modifications
PROJECT NO. Unassigned

STATUS Not Started

PRIORITY Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Install curbing around floor penetrations on floor to prevent water from draining down to lower level. Re-slope or grind floor to provide water drainage to existing floor drains.

PROJECT JUSTIFICATION
The existing concrete floor where the membrane racks sit is not level or sloped to drains. Leakage routinely occurs from the racks due to module failures and expansion/contraction of the racks. Floor penetrations are not curbed resulting in water running down on to electrical equipment on the lower level, damaging equipment and the interior walls.

RISK(S)
Continued damage to electrical and mechanic equipment and the building structure. Potential safety risk to staff entering and working in the building. Exposes the Authority and the Highland No. 1 Service Area to a potentially deficient or non-complaint water supply. Emergency/unplanned repairs will typically add 30 to 50% to the capital expenses required.

IMPACT ON OPERATIONS
Increased flexibility and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Provide covered system storage for the Highland No. 1 Service Area and eliminate the Membrane Filtration Plant.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design					140			140
Construction						730		730
Total Project Cost	**0**	**0**	**0**	**0**	**140**	**730**	**0**	**870**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**100**	**730**	**40**	**870**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.
**Includes contingencies

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Treatment Plant
PROJECT NAME	Highland Park Membrane Filtration Module Replacement Program
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replace membrane modules. The Membrane Filtration Plant (MFP) includes a total of 10 racks each with 80 modules.

PROJECT JUSTIFICATION
Membrane modules have reached the end of their useful life and are beginning to fail at an increasing rate.

RISK(S)
Exposes the Authority to higher costs to address emergency facility failures and the Highland No. 1 Service Area to a potentially deficient or non-complaint water supply.

IMPACT ON OPERATIONS
Increase operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no short term practical alternatives to the recommended action. Long term alternative is providing covered finished water storage for the Highland No. 1 Service Area and eliminating the MFP.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design			15	15				30
Construction			1,460	1,460				2,920
Total Project Cost	**0**	**0**	**1,475**	**1,475**	**0**	**0**	**0**	**2,950**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**480**	**1,480**	**990**	**0**	**0**	**2,950**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

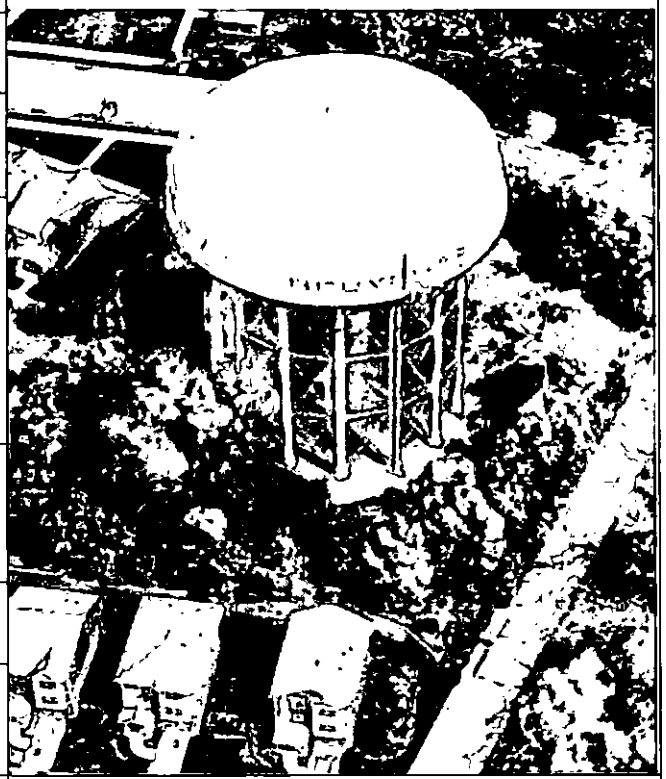
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage
PROJECT NAME	Garfield Water Storage Tank Improvements
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability, Capacity, Level of Service

NEIGHBORHOOD/WARD
Garfield/9



PROJECT DESCRIPTION
Perform a comprehensive inspection of the existing elevated storage tank, evaluate the system's need for the installation of an additional tank, and rehabilitation of the existing tank.

PROJECT JUSTIFICATION
The Garfield Elevated Storage Tank was constructed in 1959 and last rehabilitated in 1992. The existing tank does not have sufficient capacity to meet PA DEP's requirements for sizing, which states that a tank must have sufficient capacity to meet average day demand plus fire flow demand. Additionally, there are no secondary feeds into this system, which makes taking this tank out of service operationally difficult. This project will provide adequate storage through system redundancy to meet the pressure district's demand, fire flow conditions if the (New) Highland Pump Station experiences outages, and continual service to critical customers during main breaks and pump station outages.

RISK(S)
Exposes the Authority's customers to poor water quality from coating problems or a potentially deficient water supply. Due to the pressure district's demand, the existing tank cannot be removed from service for cleaning or rehabilitation.

IMPACT ON OPERATIONS
Increased flexibility and reliability, system compliance, and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Due to this pressure district's demand, critical customers served, and lack of existing capacity, replacement of the existing tank may be warranted.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		590						590
Construction			3,380					3,380
Total Project Cost	**0**	**590**	**3,380**	**0**	**0**	**0**	**0**	**3,970**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**170**	**890**	**2,730**	**180**	**0**	**0**	**3,970**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

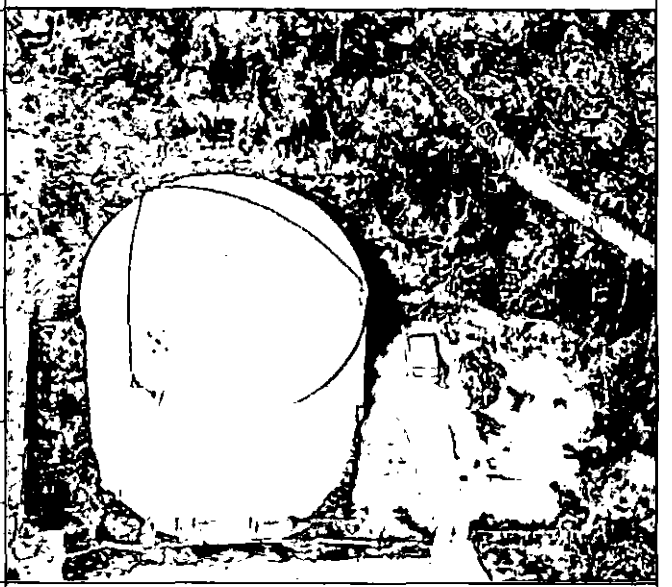
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage
PROJECT NAME	Lincoln Water Storage Tank Improvements or Replacement
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability, Capacity, Level of Service

NEIGHBORHOOD/WARD
Lincoln-Lemington/12



PROJECT DESCRIPTION
Perform a comprehensive inspection of the existing storage tank and rehabilitation or replacement of the existing tank.

PROJECT JUSTIFICATION
Constructed in 1939, this tank is nearing the end of its useful life. The last inspection, which was performed in 2008, noted deficiencies that need to be addressed to ensure water quality standards are met.

RISK(S)
Exposes the Authority's customers to poor water quality from coating problems or a potentially deficient water supply in the event of tank failure.

IMPACT ON OPERATIONS
Increased flexibility and reliability and system compliance.

ALTERNATIVES TO THE RECOMMENDED ACTION
Rehabilitation of the existing tank, which may be a larger investment than replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		610	0					610
Construction			3,500					3,500
Total Project Cost	**0**	**610**	**3,500**	**0**	**0**	**0**	**0**	**4,110**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**170**	**930**	**2,830**	**180**	**0**	**0**	**4,110**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Spring Hill Water Storage Tanks Improvements or Replacement		
PROJECT NO.	Unassigned		
STATUS	Not Started	**PRIORITY**	Safety, Regulatory Compliance, Reliability, Capacity, Level of Service

NEIGHBORHOOD/WARD
City View, Spring Hill, Spring Garden, Troy Hill/24,26



PROJECT DESCRIPTION
Perform a comprehensive inspection of the existing storage tanks and rehabilitation or replacement of the existing tanks.

PROJECT JUSTIFICATION
Constructed in 1929 of riveted steel, the coatings and structure of these tanks may require rehabilitation due to corrosion. The existing shell ladder, ladder cage, and rolling roof ladder do not meet current OSHA dimensional requirements.

RISK(S)
Exposes the Authority's customers to poor water quality from coating problems or a potentially deficient water supply in the event of tank failure. Additionally, it exposes the Authority's staff and contractors to safety issues.

IMPACT ON OPERATIONS
Increased flexibility and reliability and system compliance.

ALTERNATIVES TO THE RECOMMENDED ACTION
Rehabilitation of the existing tank, which may be a larger investment than replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design			310					310
Construction				1,820				1,820
Total Project Cost	**0**	**0**	**310**	**1,810**	**0**	**0**	**0**	**2,130**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**90**	**480**	**1,460**	**100**	**0**	**2,130**

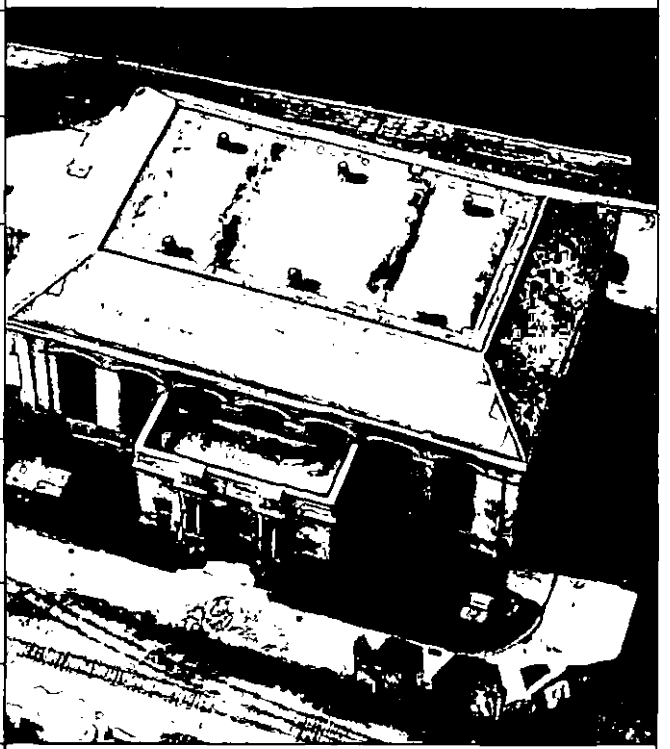
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage
PROJECT NAME	Aspinwall Pump Station Improvements
PROJECT NO.	Unassigned
STATUS	Assessment/Study
PRIORITY	Safety, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems.

PROJECT JUSTIFICATION
The pump station was constructed in 1914 and many of the components were installed in 1958. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. Additionally, installation of variable frequency drives will reduce water pressure surges during start-up that can detrimentally impact the 60-inch rising main to Lanpher Reservoir, allow the pumps to operate over a wide range of flow, and will reduce the required size of the new clearwell.

RISK(S)
Exposes the Authority's to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	100							100
Design		2,770						2,770
Construction				26,590				26,590
Total Project Cost	**100**	**2,770**	**0**	**26,590**	**0**	**0**	**0**	**29,460**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**400**	**1,820**	**3,290**	**10,095**	**10,095**	**3,760**	**29,460**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Pumping and Storage
PROJECT NAME Bruecken Pump Station Improvements
PROJECT NO. Unassigned

NEIGHBORHOOD/WARD
Systemwide

STATUS Assessment/Study

PRIORITY Safety, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems.

PROJECT JUSTIFICATION
The pump station was constructed in 1931. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. Additionally, installation of variable frequency drives will reduce water pressure surges during start-up, allow the pumps to operate more efficiently over a wide range of flow demands, and will reduce the required size of the new clearwell.

RISK(S)
Exposes the Authority to higher capital costs to address emergency facility failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	100							100
Design		2,410						2,410
Construction				22,570				22,570
Total Project Cost	**100**	**2,410**	**0**	**22,570**	**0**	**0**	**0**	**25,080**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**365**	**1,580**	**2,820**	**8,560**	**8,560**	**3,195**	**25,080**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Garfield Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Design	**PRIORITY**	Safety, Reliability/Operational Flexibility, Capacity, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Garfield/10



PROJECT DESCRIPTION
Installation of an interim skid mounted, fully enclosed, packaged pump station with a pumping capacity of 5 MGD, emergency pipe connections, and integration into PWSA's SCADA system for remote monitoring and operation. At a minimum, rehabilitation of the existing station will include installation of new electrical components, variable frequency drives, pumps, motors, and valves. In addition, improvements to HVAC and ancillary building systems are anticipated. Upon completion of the rehabilitation, the interim pump station will be removed and utilized for future pump station rehabilitation and upgrade projects, and will be available for emergency service.

PROJECT JUSTIFICATION
The Garfield Pump Station supplies water from Highland Reservoir No. 1 to the Garfield Tank and is the only means of service to the Garfield Tank, with no other pump station or interconnection available to supply water to the district. Due to safety and reliability concerns, Operations has determined it is no longer safe to enter the pump station.

RISK(S)
An interruption in the supply of water, including fire flow, to the Garfield pressure district. Significant health and safety risk to staff.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station and allow for pumping from Highland No. 2 Reservoir to Highland No. 1 Service Area. See Highland Reservoir Pump Station and Rising Main.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	90	610						700
Construction	620		3,530					4,150
Total Project Cost	**710**	**610**	**3,530**	**0**	**0**	**0**	**0**	**4,850**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**880**	**680**	**2,865**	**425**	**0**	**0**	**4,850**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

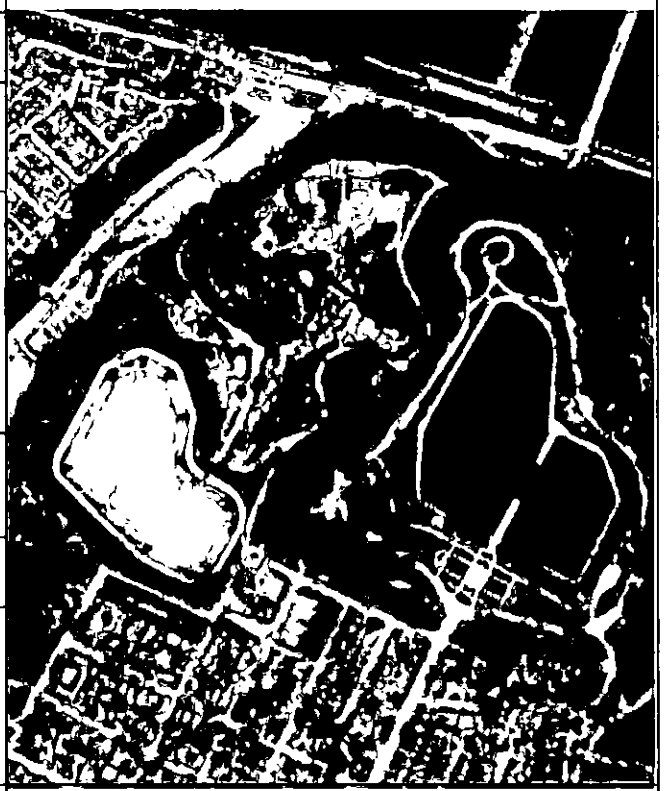
**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage
PROJECT NAME	Highland Reservoir Pump Station and Rising Main
PROJECT NO.	Unassigned
STATUS	New
PRIORITY	Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Construction of a new finished water pump station and transmission main to supply water to the Highland No.1 Service Area from Highland No. 2 Reservoir.

PROJECT JUSTIFICATION
All compliant water supply for the Highland No. 1 Service Area currently flows through the Highland No. 1 Reservoir and the Membrane Filtration Plant (MFP). There is no other source water supply for the Highland No. 1 Service Area. In addition to providing alternate supply, this project is to temporarily provide finished water that meets the chlorine disinfection rules to the Highland No. 1 Service Area during the Clearwell Replacement Project. Additionally, this new facility could also be designed to service the Garfield pressure district, thus eliminating the rehabilitation of the (New) Highland Pump Station.

RISK(S)
Failure of the two Rising Mains (No.1 or No. 2), MFP, or Bruecken Pump Station would result in the loss of compliant water supply to approximately 40% of the Authority's customer base.

IMPACT ON OPERATIONS
Increased operation and maintenance labor and expenses. Increased operating flexibility in the future.

ALTERNATIVES TO THE RECOMMENDED ACTION
Alternative 1: Construction of a new clearwell at the site of the existing west sedimentation basin. However, a previous study conducted by an engineering consultant still recommended the addition of these assets as part of the Clearwell Replacement project.
Alternative 2: Inclusion in the expansion and rehabilitation of the existing (New) Highland Pump Station.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		3,520						3,520
Construction				28,170				28,170
Total Project Cost	**0**	**3,520**	**0**	**28,170**	**0**	**0**	**0**	**31,690**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**610**	**1,990**	**2,800**	**10,700**	**10,700**	**4,890**	**31,690**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

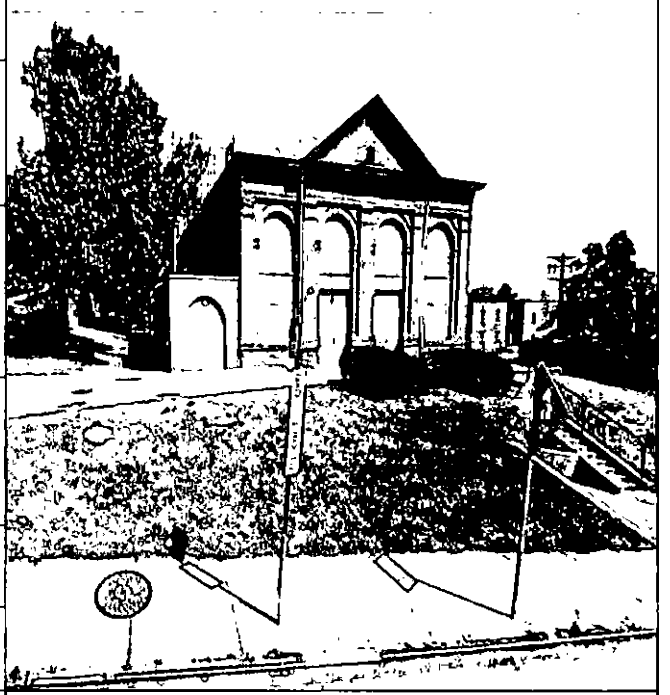
*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Herron Hill Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Squirrel Hill, Regent Square, Point Breeze, Greenfield/14



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station was originally constructed in the late 1890's. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	50							50
Design							1,130	1,130
Construction							9,180	9,180
Total Project Cost	**50**	**0**	**0**	**0**	**0**	**0**	**10,310**	**10,360**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**50**	**0**	**0**	**0**	**0**	**10,310**	**10,360**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

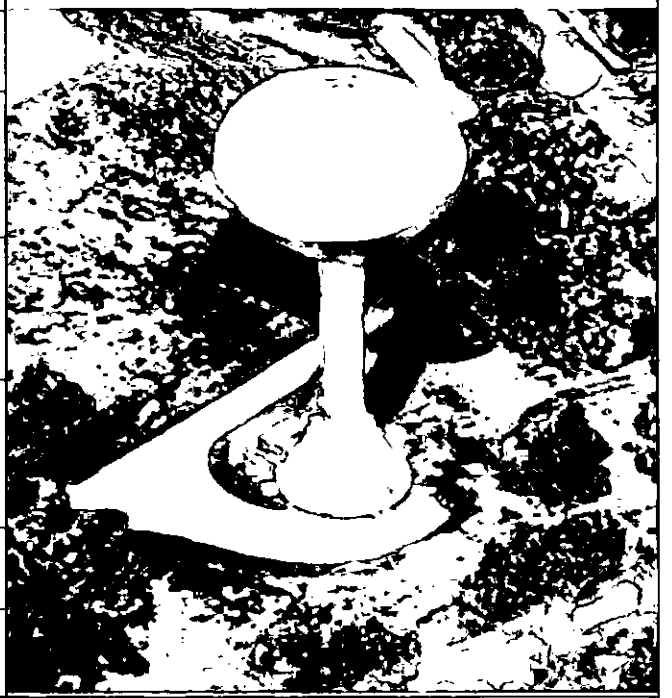
**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Herron Hill Tank Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Upper Hill/5



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	8							8
Design							130	130
Construction							890	890
Total Project Cost	**8**	**0**	**0**	**0**	**0**	**0**	**1,020**	**1,028**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**8**	**0**	**0**	**0**	**0**	**1,020**	**1,028**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

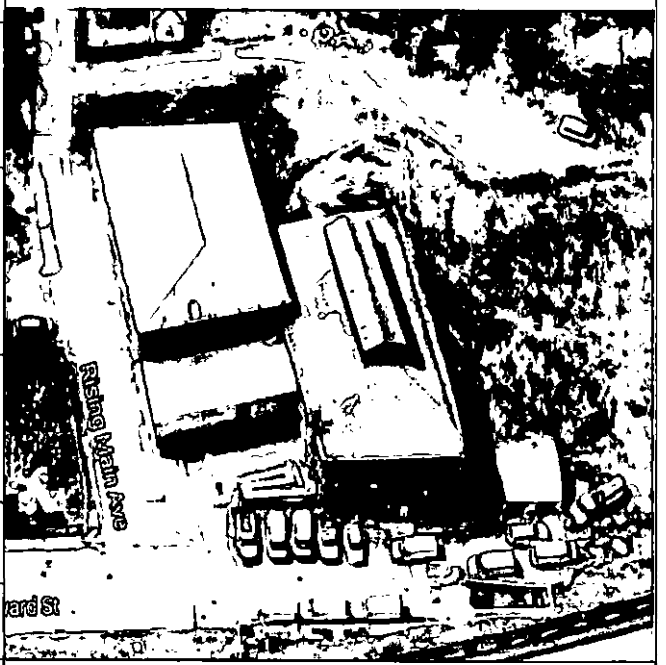
[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Howard Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Brighton Heights, California Kirkbride, Marshall-Shadeland, Northview Heights, Perry, Pineview, Spring Garden, Summer Hill/21, 24, 25, 26, 27



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station was originally constructed between 1900 and 1904. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	85							85
Design							1,900	1,900
Construction							15,410	15,410
Total Project Cost	**85**	**0**	**0**	**0**	**0**	**0**	**17,310**	**17,395**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**85**	**0**	**0**	**0**	**0**	**17,310**	**17,395**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

Exh. RAW/C-8

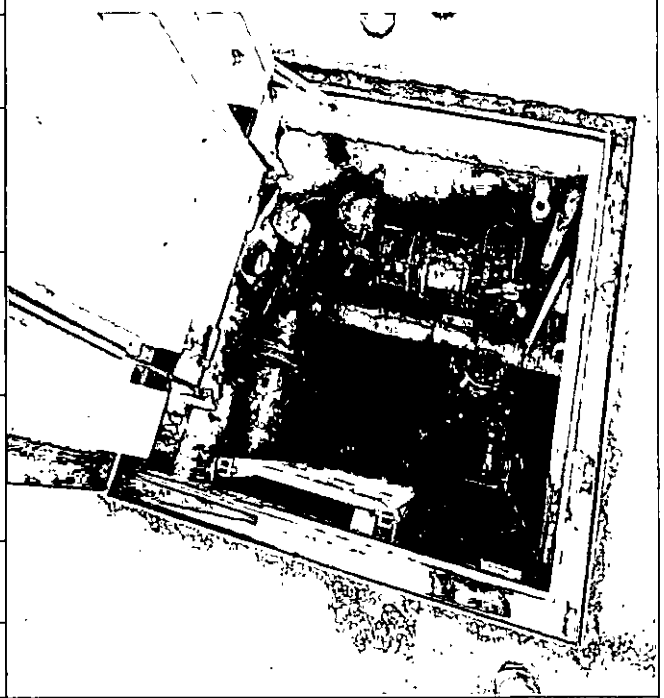
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Pumping and Storage
PROJECT NAME Inline Pump Station (Coral and Pacific) Improvements
PROJECT NO. Unassigned

STATUS Assessment/Study

PRIORITY Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Bloomfield//8



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	10							10
Design		80						80
Construction			510					510
Total Project Cost	**10**	**80**	**510**	**0**	**0**	**0**	**0**	**600**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**65**	**510**	**25**	**0**	**0**	**0**	**600**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Lincoln Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Lincoln-Lemington/12



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station was originally constructed in 1952. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	20							20
Design							350	350
Construction							2,550	2,550
Total Project Cost	**20**	**0**	**0**	**0**	**0**	**0**	**2,900**	**2,920**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**20**	**0**	**0**	**0**	**0**	**2,900**	**2,920**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

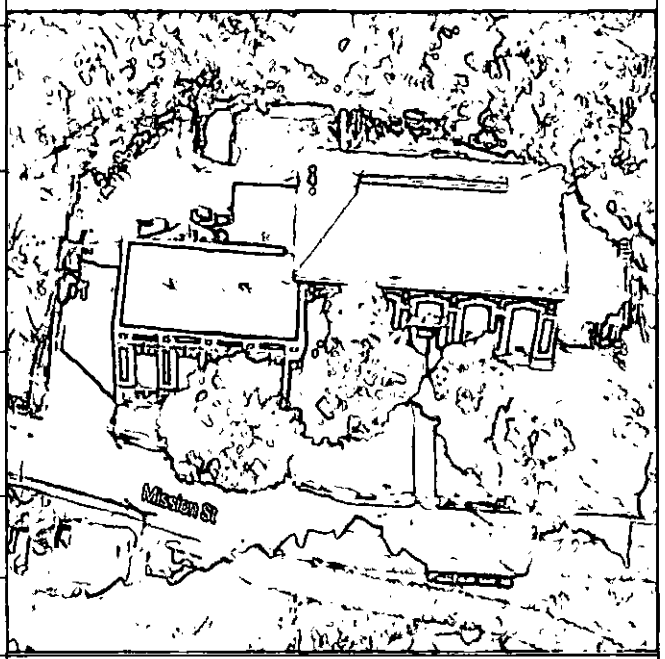
[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Mission Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Sheradan, Elliott, West End, Westwood, Ridgemont, Duquesne Heights, South Shore, Mount Washington, Allentown, Southside Slopes/16, 17, 18, 20



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The Mission Pump Station is the only pumping station located south of the Monongahela River and was originally constructed between 1910 and 1912. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	65							65
Design							1,725	1,725
Construction							13,995	13,995
Total Project Cost	**65**	**0**	**0**	**0**	**0**	**0**	**15,720**	**15,785**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**65**	**0**	**0**	**0**	**0**	**15,720**	**15,785**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

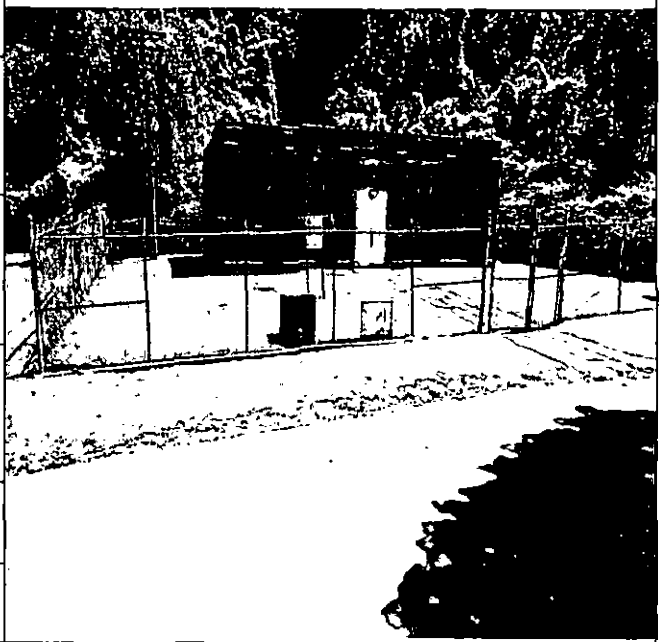
**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Pumping and Storage		
PROJECT NAME	Saline Pump Station Improvements		
PROJECT NO.	Unassigned		
STATUS	Assessment/Study	**PRIORITY**	Safety, Reliability/Operational Flexibility, Operations and Maintenance Efficiency, Level of Service

NEIGHBORHOOD/WARD
Glen Hazel, Hazelwood, Squirrel Hill South, Swisshelm Park/ 14, 15



PROJECT DESCRIPTION
Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems as prioritized by the recommended Finished Water Pump Stations Condition Assessment Project.

PROJECT JUSTIFICATION
The pump station was originally constructed in 1935. The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. To optimize capital expenditures and minimize disruptions, construction projects must be prioritized and coordinated.

RISK(S)
Lack of facility planning exposes PWSA to higher capital costs to address emergency failures and its customers to a potentially deficient water supply. Potential increase of operations and maintenance expenses. Staff members may be exposed to electrical arc flashes due to the age of the electrical systems.

IMPACT ON OPERATIONS
Increased operating efficiency, flexibility, and reliability and improved safety conditions for staff.

ALTERNATIVES TO THE RECOMMENDED ACTION
Construction of a new facility to replace the existing pump station.

COMMITMENT SCHEDULE*[1] (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study	15							15
Design							400	400
Construction							2,900	2,900
Total Project Cost	**15**	**0**	**0**	**0**	**0**	**0**	**3,300**	**3,315**

CASH FLOW SUMMARY[1] (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**15**	**0**	**0**	**0**	**0**	**3,300**	**3,315**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☒Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

[1] Pending completion and review of the recommendations from the Recommended Pump Station Assessment Project, the commitment and cash flow will be refined.

Exh. RAW/C-8

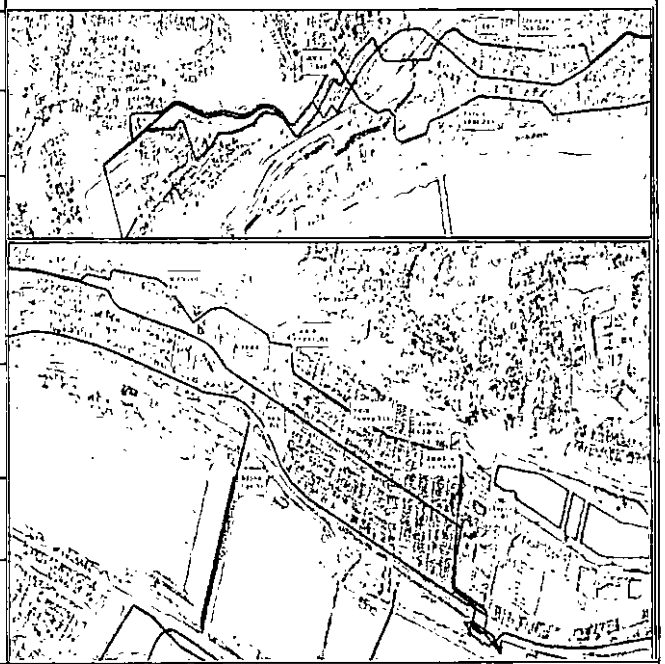
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Pumping and Storage
PROJECT NAME Aspinwall Pump Station to Lanpher Reservoir Rising Main
PROJECT NO. 2013-930-231-0

NEIGHBORHOOD/WARD
Systemwide

STATUS Design

PRIORITY Regulatory Compliance, Reliability/Operational Flexibility, Level of Service



PROJECT DESCRIPTION
Construction of a new, redundant rising main from Aspinwall Pump Station to Lanpher Reservoir.

PROJECT JUSTIFICATION
The existing 60-inch rising main that supplies the Lanpher Reservoir is a 150 year old riveted steel pipe, has several tap connections to critical and bulk customers, and has experienced recent pipe failures. The new proposed rising main would serve as a primary supply source for Lanpher Reservoir during the Clearwell Replacement Project and a redundant supply line in case of a failure or planned cleaning and rehabilitation of the existing 60-inch supply main.

RISK(S)
Failure of the rising main could impact up to half of PWSA's customers, including St. Margaret Hospital, and other bulk customers, including Aspinwall, Blawnox, Etna, Sharpsburg, Fox Chapel, and Shaler.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Rehabilitation of the existing 60-inch supply main and construction of a parallel main in sections that cannot be currently isolated to clean, inspect, or rehabilitate.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	156	5,160						5,316
Construction				43,520				43,520
Total Project Cost	**156**	**5,160**	**0**	**43,520**	**0**	**0**	**0**	**48,836**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**156**	**510**	**2,720**	**2,100**	**24,770**	**18,580**	**0**	**48,836**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

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FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Distribution System
PROJECT NAME Lead Service Line Replacement Program
PROJECT NO. 2016-325-105-0

NEIGHBORHOOD/WARD
Systemwide

STATUS Design | **PRIORITY** Safety, Regulatory Compliance

PROJECT DESCRIPTION
Replacement of 7% of lead service lines per year.

PROJECT JUSTIFICATION
Due to the exceedance of the action levels from compliance tests for lead and copper, the Pennsylvania Department of Environmental Protection required the Authority to perform additional distribution system water quality monitoring, optimization of corrosion control treatment, public education, and lead service line replacement.

RISK(S)
Failure to comply will result in regulatory fines and poses a public health risk.

IMPACT ON OPERATIONS
Reduction in service line failure due to replacing with new infrastructure, reducing demands on Operations Repair Crews.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.



COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		780	555	570	585	615	Ongoing	3,105
Construction		22,920	16,305	16,800	17,295	17,825	Ongoing	91,145
Total Project Cost	**0**	**23,700**	**16,860**	**17,370**	**17,880**	**18,440**	**Ongoing**	**94,250**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**11,480**	**16,490**	**16,990**	**17,500**	**18,030**	**Ongoing**	**80,490⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

⁺Total shown is expenditures through FY2021.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Water Distribution System
PROJECT NAME Large Diameter Water Main Rehabilitation or Replacement Program
PROJECT NO. Annual

NEIGHBORHOOD/WARD
Systemwide

STATUS Not Started

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service



PROJECT DESCRIPTION
Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections.

PROJECT JUSTIFICATION
PWSA's water system has approximately 122 miles of large diameter water mains. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings.

RISK(S)
The consequences of failure for larger mains are much greater than for smaller distribution mains, which typically include significant service outages (larger area and longer time frame impacts), as well as property and roadway damage. This is especially true for the Highland No. 1 Pressure District and all districts fed by Highland No. 1.

IMPACT ON OPERATIONS
Increased system reliability and improved sytem management.

ALTERNATIVES TO THE RECOMMENDED ACTION
Continue to extend utility component life until a high failure rate justifies replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study			130	2,400	2,480	2,550	Ongoing	7,560
Design				1,360	1,390	1,440	Ongoing	4,190
Construction						11,100	Ongoing	11,100
Total Project Cost	**0**	**0**	**130**	**3,760**	**3,870**	**15,090**	**Ongoing**	**22,850**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**90**	**1,515**	**3,760**	**6,160**	**Ongoing**	**11,525+**

FUNDING SOURCE(S)

☒Capital
☒Expense: ☐Engineering ☐Sewer ☒Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

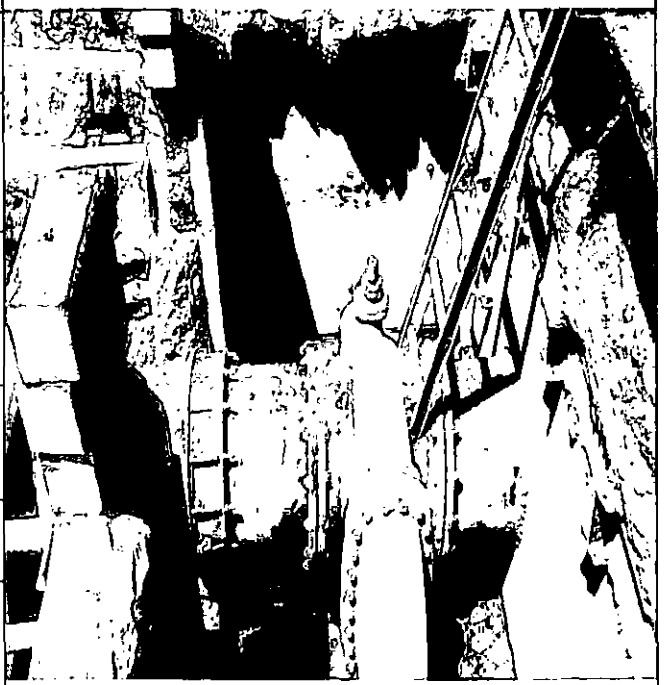
+Total shown is expenditures through FY2021.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System
PROJECT NAME	Large Valve Replacement Program
PROJECT NO.	Annual
STATUS	Not Started
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of existing (defective or non-operational) or installation of new large diameter valves, including pressure reducing valves and air release valves, on 16-inch and larger diameter water mains throughout the water distribution system.

PROJECT JUSTIFICATION
Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions. Additionally, they are required for the inspection and rehabilitation of the mains.

RISK(S)
The consequences of failure for larger mains are much greater than for smaller distribution mains, which could include significant service outages.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design			460	475	490	500	Ongoing	1,925
Construction				3,425	3,530	3,640	Ongoing	10,595
Total Project Cost	**0**	**0**	**460**	**3,900**	**4,020**	**4,140**	**Ongoing**	**12,520**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**400**	**3,095**	**3,875**	**3,995**	**Ongoing**	**11,365+**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

+Total shown is expenditures through FY2021.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System		
PROJECT NAME	Valve Replacement Program		
PROJECT NO.	Annual		
STATUS	Construction	**PRIORITY**	Safety, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during waterline relays.

PROJECT JUSTIFICATION
Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.

RISK(S)
A larger number of customers may be subject to service outages.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		30	30	35	35	35	Ongoing	165
Construction	2,400	2,915	3,155	3,265	3,380	3,380	Ongoing	18,495
Total Project Cost	**2,400**	**2,945**	**3,185**	**3,300**	**3,415**	**3,415**	**Ongoing**	**18,660**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**1,140**	**2,210**	**3,770**	**2,990**	**3,360**	**3,420**	**Ongoing**	**16,890⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

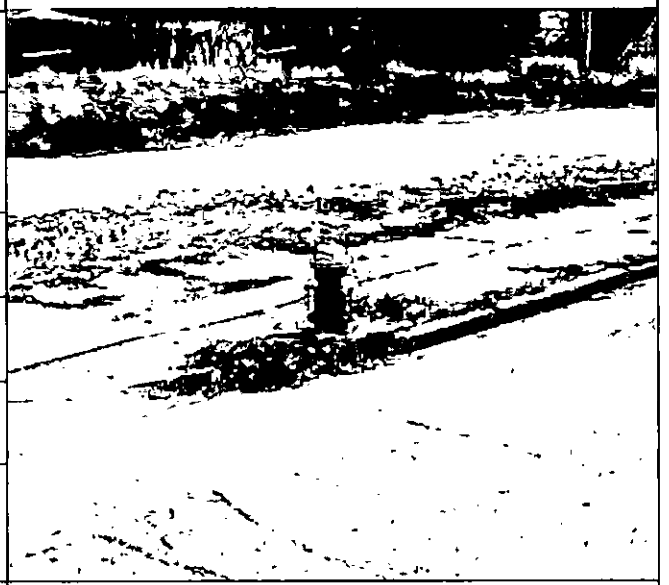
⁺Total shown is expenditures through FY2021.

Exh RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System
PROJECT NAME	Hydrant Replacement Program
PROJECT NO.	Annual
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of broken hydrants throughout the water distribution system. Program goal is to replace a minimum of 100 hydrants per year, excluding hydrants replaced during waterline relays.

PROJECT JUSTIFICATION
Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.

RISK(S)
Customers will be subject to inadequate pressure for firefighting activities.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		20	20	20	20	20	Ongoing	100
Construction		1,160	1,295	1,295	1,410	1,410	Ongoing	6,570
Total Project Cost	**0**	**1,180**	**1,315**	**1,315**	**1,430**	**1,430**	**Ongoing**	**6,670**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**390**	**1,220**	**1,320**	**1,350**	**1,430**	**Ongoing**	**5,710⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

⁺Total shown is expenditures through FY2021.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System
PROJECT NAME	Small Diameter Main Replacement and Fire Protection Distribution System Improvements
PROJECT NO.	2013-325-288-0, 2013-325-211-0, Annual
STATUS	Design
PRIORITY	Safety, Reliability/Operational Flexibility, Regional Cooperation/Stewardship, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Strategic replacement of water mains to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. Program will initially focus on replacing existing 4-inch and 6-inch unlined cast iron mains and mains with a history of frequent breaks.

PROJECT JUSTIFICATION
By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.

RISK(S)
Customers may be subject to service outages or the potential for inadequate pressure for firefighting activities.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Continue to extend utility component life until a high failure rate justifies replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	364	1,330	2,015	2,680	3,455	Ongoing	Ongoing	9,844
Construction	5,406	0	9,195	14,060	19,170	24,705	Ongoing	72,536
Total Project Cost	**5,770**	**1,330**	**11,210**	**16,740**	**22,625**	**24,705**	**Ongoing**	**82,380**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**4,070**	**2,360**	**5,330**	**15,290**	**19,770**	**22,600**	**Ongoing**	**69,420⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

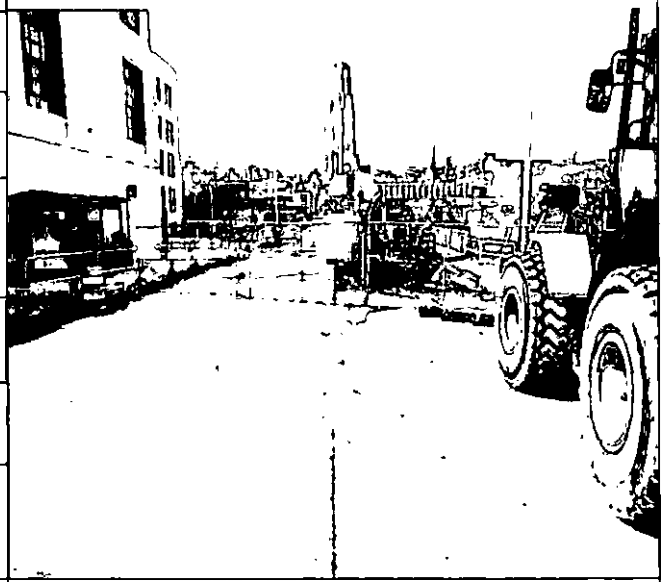
⁺Total shown is expenditures through FY2021.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System
PROJECT NAME	Urgent Water Relay
PROJECT NO.	2016-325,102-0, Annual
STATUS	Construction
PRIORITY	Safety, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.

PROJECT JUSTIFICATION
The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.

RISK(S)
Customers will be subject to service outages or inadequate pressure for firefighting activities until break is addressed.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design	45	165	180	195	195	195	Ongoing	975
Construction	1,225	1,305	1,420	1,525	1,525	1,525	Ongoing	8,525
Total Project Cost	**1,270**	**1,470**	**1,600**	**1,720**	**1,720**	**1,720**	**Ongoing**	**9,500**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**270**	**1,420**	**1,510**	**1,630**	**1,720**	**1,720**	**Ongoing**	**8,270†**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

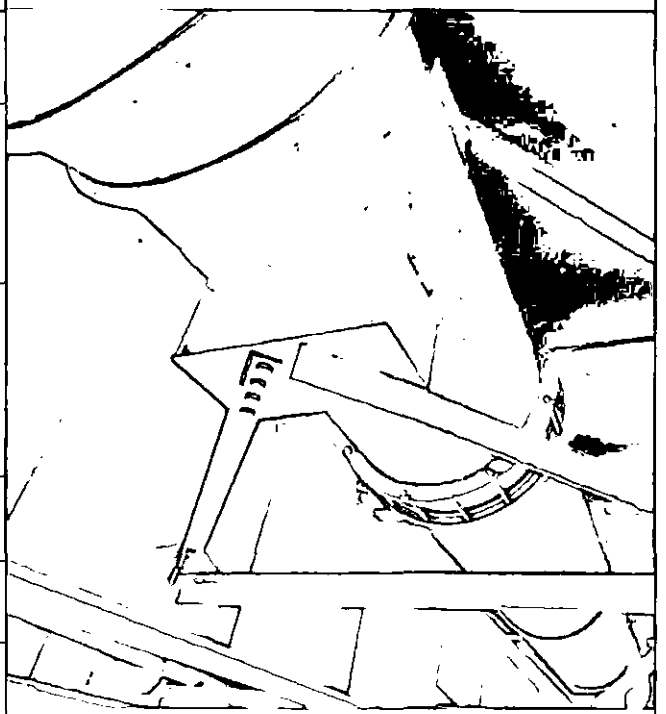
†Total shown is expenditures through FY2021.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System
PROJECT NAME	Ft. Duquesne Bridge Water Air Release Valve Repair
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Safety, Reliability/Operational Flexibility, Regional Cooperation/Stewardship, Level of Service

NEIGHBORHOOD/WARD
North Shore & Central Business District/1,22



PROJECT DESCRIPTION
Perform transient analysis along existing 30-inch water main that is suspended from the Fort Duquesne Bridge. Design and construct new pipe supports and thrust restraint based on the results of the analysis. Includes the replacement of the existing air-release valve on the 30-inch water main, including insulation or heat tracing to reduce potential for freezing and cracking of the valve.

PROJECT JUSTIFICATION
A recent PENNDOT inspection of the Fort Duquesne Bridge identified priority code 1 defects in the support of the existing 30-inch diameter water main. Additionally, the existing 2-inch diameter air-release valve located on the main has a history of failure. The water main is located below the lower deck of the Fort Duquesne Bridge and serves as an emergency interconnection between pressure gradients and is a vital component to the system operation.

RISK(S)
Customers may be subject to service outages or the potential for inadequate pressure for firefighting activities.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		135						135
Construction		635						635
Total Project Cost	**0**	**770**	**0**	**0**	**0**	**0**	**0**	**770**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**100**	**640**	**30**	**0**	**0**	**0**	**770**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

Exh. RAW/C-B

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Water Distribution System		**NEIGHBORHOOD/WARD**
PROJECT NAME	Washout Disconnection Program		Systemwide
PROJECT NO.	Annual		
STATUS	Not Started	**PRIORITY**	Safety, Regulatory Compliance, Level of Service

PROJECT DESCRIPTION
Investigation and, if necessary, disconnection of large water main washouts from the sewer system.

PROJECT JUSTIFICATION
A number of older washouts on larger mains were directly connected to sewers with a closed valve during construction. These washouts must be completely disconnected from the sewer.

RISK(S)
Customers may be subject to health impacts, if the valves were accidentally opened or broken, due to cross contamination.

IMPACT ON OPERATIONS
Increased operating flexibility.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design							2,120	2,120
Construction							11,590	11,590
Total Project Cost	**0**	**0**	**0**	**0**	**0**	**0**	**13,710**	**13,710**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**0**	**0**	**13,710**	**13,710**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

†Total shown is expenditures through FY2021.

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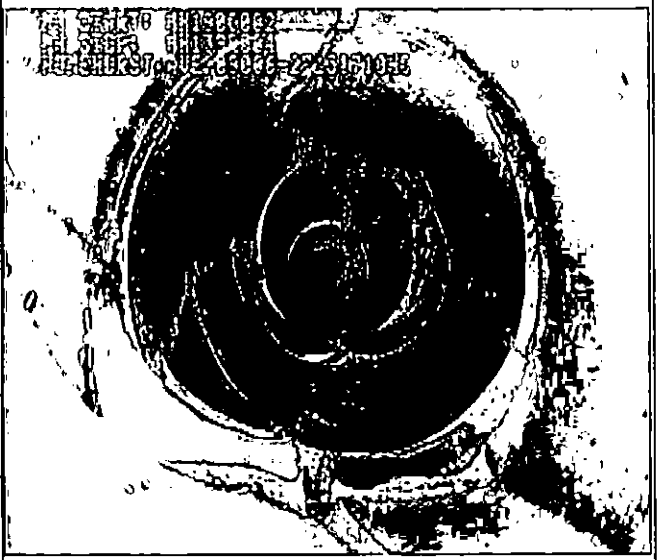
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Wastewater System		
PROJECT NAME	Urgent Sewer Reconstruction		
PROJECT NO.	Annual		
STATUS	Construction	**PRIORITY**	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.

PROJECT JUSTIFICATION
The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.

RISK(S)
Customers may be subject to basement backups or overflows may occur due to collapsed pipes. The Authority may be subject to related fines due to sewer overflows or for non-compliance as outlined in the Consent Order and Agreement.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		165	180	195	195	195	Ongoing	930
Construction	1,005	1,305	1,420	1,525	1,525	1,525	Ongoing	8,305
Total Project Cost	**1,005**	**1,470**	**1,600**	**1,720**	**1,720**	**1,720**	**Ongoing**	**9,235**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**10**	**1,415**	**1,510**	**1,630**	**1,720**	**1,720**	**Ongoing**	**8,005†**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

†Total shown is expenditures through FY2021.

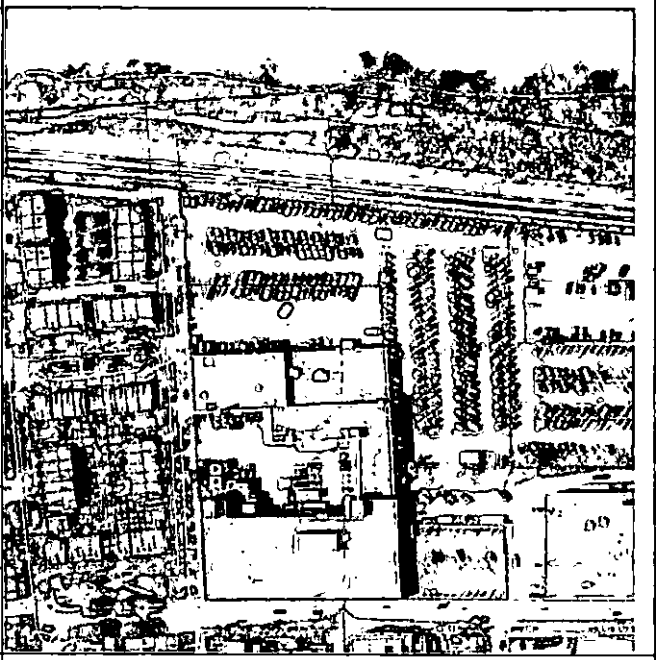
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Wastewater System
PROJECT NAME Sewers Under Critical Structures Program
PROJECT NO. Annual

STATUS Design

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.

PROJECT JUSTIFICATION
In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.

RISK(S)
Failure of this asset type could result in significant property/structure damage, increased replacement cost, and increased service outages or bypass pumping.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Continue to extend utility component life until a high failure rate justifies replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		758	780	803	827	852	Ongoing	4,020
Construction			5,824	5,993	6,173	6,363	Ongoing	24,353
Total Project Cost	**0**	**758**	**6,604**	**6,796**	**7,000**	**7,215**	**Ongoing**	**28,373**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**675**	**6,090**	**6,615**	**6,875**	**7,015**	**Ongoing**	**27,270⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

⁺Total shown is expenditures through FY2021.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Wastewater System
PROJECT NAME	Small Diameter Sewer Rehabilitation Program
PROJECT NO.	Annual
STATUS	Design
PRIORITY	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Proactive, trenchless rehabilitation of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow; including cleaning and pre and post construction CCTV inspections.

PROJECT JUSTIFICATION
Provides the Authority with a means to address several moderate/major structural defects in pipe segments prior to complete failure. This trenchless pipe renewal method renews the asset, eliminates disruptive excavation, and is more cost effective than replacement.

RISK(S)
If moderate/major structural defects are not proactively addressed, complete failure will eventually occur and excavation will be required. Any complete failure that occurs will result in dramatically increased expenditures for repair.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Perform excavated point repairs to address defective sections of pipe, replace segment in its entirety, or continue to extend asset life until failure.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		670	820	985	1,165	1,320	Ongoing	4,960
Construction		6,690	8,290	9,985	11,795	13,620	Ongoing	50,380
Total Project Cost	**0**	**7,360**	**9,110**	**10,970**	**12,960**	**14,940**	**Ongoing**	**55,340**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**660**	**7,510**	**9,270**	**11,150**	**13,120**	**Ongoing**	**41,710⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

⁺Total shown is expenditures through FY2021.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Wastewater System
PROJECT NAME Large Diameter Sewer Rehabilitation Program
PROJECT NO. Annual

STATUS Design

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Proactive, trenchless rehabilitation of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow; including cleaning and pre and post construction CCTV inspections.

PROJECT JUSTIFICATION
Provides the Authority with a means to address several moderate/major structural defects in pipe segments prior to complete failure. This trenchless pipe renewal method renews the asset, eliminates disruptive excavation, and is more cost effective than replacement.

RISK(S)
If moderate/major structural defects are not proactively addressed, complete failure will eventually occur and excavation will be required. Any complete failure that occurs will result in dramatically increased expenditures for repair.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Perform excavated point repairs to address defective sections of pipe, replace segment in its entirety, or continue to extend asset life until failure.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		175	340	515	705	745	Ongoing	2,480
Construction		1,615	3,400	5,235	7,155	7,365	Ongoing	24,770
Total Project Cost	**0**	**1,790**	**3,740**	**5,750**	**7,860**	**8,110**	**Ongoing**	**27,250**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**170**	**1,950**	**3,920**	**5,930**	**7,880**	**Ongoing**	**19,850+**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

+Total shown is expenditures through FY2021.

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Wastewater System
PROJECT NAME	2018 Wastewater System Improvements
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Various



PROJECT DESCRIPTION
Reconstruction of existing sewer mains on Wiese Street, Wilbur Street, Creedmoor Avenue, Ornament Way, Cooperfield Avenue, N. Sheridan Avenue, Port Way, and Swimburne Street.

PROJECT JUSTIFICATION
Repairs were issued on previous annual contracts; however, were not performed due to utility conflicts and limited site access.

RISK(S)
Customers may be subject to basement backups or overflows may occur due to collapsed pipes. The Authority may be subject to related fines due to sewer overflows or for non-compliance as outlined in the Consent Order and Agreement.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform all repairs and manhole installations. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		880						880
Construction			4,390					4,390
Total Project Cost	**0**	**880**	**4,390**	**0**	**0**	**0**	**0**	**5,270**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**365**	**3,120**	**1,785**	**0**	**0**	**0**	**5,270**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

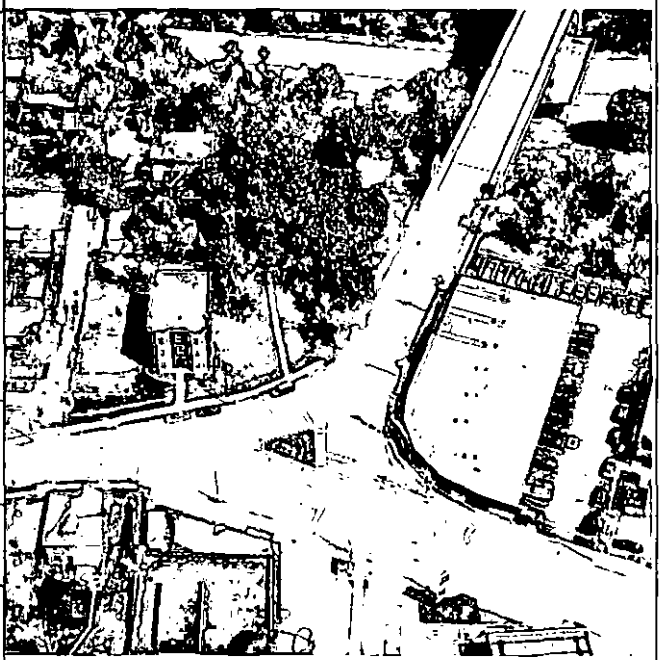
**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Wastewater System
PROJECT NAME	Beechwood Boulevard/Greenfield Bridge Sewer Replacement
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Greenfield/15



PROJECT DESCRIPTION
Installation of a new sanitary sewer and appurtenances, including grinder pumps, on Exposition Way to existing manhole MH054L013 on Alger Street to provide permanent service for 4101 and 4103 Beechwood Boulevard.

PROJECT JUSTIFICATION
Gray water began surfacing at the Greenfield Bridge construction site. Dye testing at 4101 and 4103 Beechwood Boulevard revealed that these properties were the source of the gray water. A concrete holding tank was installed to temporarily collect the sanitary flows from these properties until a new sanitary sewer is constructed to service these properties.

RISK(S)
The concrete holding tank was installed as a temporary measure only and permanent sewer service needs to be restored.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Installation of a new sanitary sewer and appurtenances from Beechwood Boulevard to the existing 30-inch main.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		140						140
Construction		550						550
Total Project Cost	**0**	**690**	**0**	**0**	**0**	**0**	**0**	**690**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**420**	**270**	**0**	**0**	**0**	**0**	**690**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

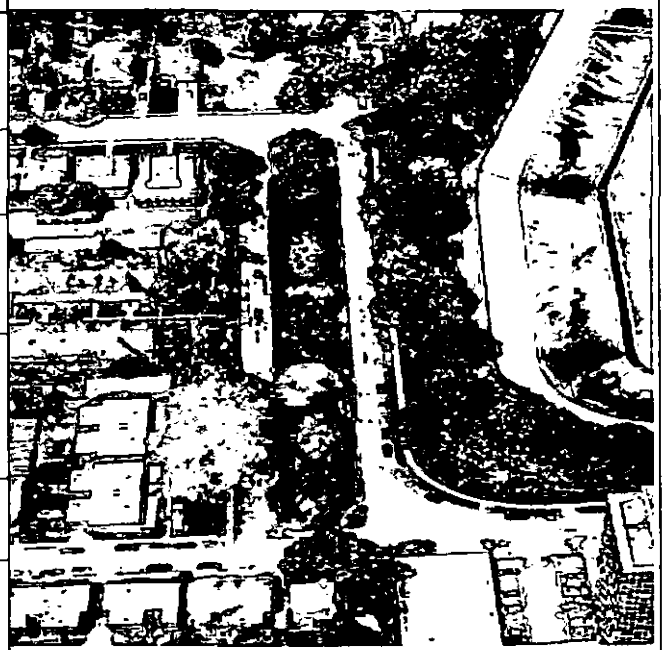
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Wastewater System
PROJECT NAME Mellon Terrace Sewer System Improvements
PROJECT NO. Unassigned

NEIGHBORHOOD/WARD
Highland Park/11

STATUS Design

PRIORITY Regulatory Compliance, Reliability/Operational Flexibility, Regional Cooperation/ Stewardship, Level of Service



PROJECT DESCRIPTION
Realignment of approximately 665 linear feet of 24-inch combined sewer main on Mellon Terrace.

PROJECT JUSTIFICATION
Repairs were issued on previous annual contracts; however, were not performed due to depth and soil conditions. Additionally, the Department of Public Works is planning to repair/rebuild the roadway.

RISK(S)
Customers may be subject to basement backups or overflows may occur due to collapsed pipes. The Authority may be subject to related fines due to sewer overflows or for non-compliance as outlined in the Consent Order and Agreement.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Utilize Authority staff and equipment to perform the repairs. This would require an increase in operations expenses for both personnel and equipment.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design					345			345
Construction					1,685			1,685
Total Project Cost	**0**	**0**	**0**	**0**	**2,030**	**0**	**0**	**2,030**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**340**	**1,690**	**0**	**2,030**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☒Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Wastewater System
PROJECT NAME	31st Ward Sewer System
PROJECT NO.	Unassigned
STATUS	Design
PRIORITY	Regulatory Compliance, Reliability/Operational Flexibility, Regional Cooperation/ Stewardship, Level of Service

NEIGHBORHOOD/WARD
Lincoln Place/31



PROJECT DESCRIPTION
Evaluation to identify and locate the source(s) of the infiltration and inflow (I/I), removal of public I/I sources, and rehabilitation/replacement of the Rogers Street and Mifflin Road Pump Station and force main.

PROJECT JUSTIFICATION
Both sewage pump stations and the force main that convey flow to the Streets Run Sanitary Trunk Sewer were constructed in the late 1940's and are reaching the end of their useful life. Additionally, past studies suggest this sewershed may be significantly impacted by high levels of infiltration/inflow.

RISK(S)
The Authority may be subject to related fines due sanitary sewer overflows caused by pump station system failures or excessive infiltration and inflow in the system.

IMPACT ON OPERATIONS
Increased operating flexibility and reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Abandonment of the existing pump stations and installation of a new gravity main to convey flows to the West Mifflin Sanitary Authority.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		1,520						1,520
Construction			12,000					12,005
Total Project Cost	**0**	**1,520**	**12,000**	**0**	**0**	**0**	**0**	**13,520**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**480**	**1,910**	**9,730**	**1,400**	**0**	**0**	**13,520**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Stormwater System
PROJECT NAME Stormwater System Improvements
PROJECT NO. Annual

STATUS Design

PRIORITY Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Regional Cooperation/ Stewardship, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Strategic replacement or rehabilitation of storm mains to improve system reliability and minimize disturbance to the community.

PROJECT JUSTIFICATION
By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs.

RISK(S)
Overland and street flooding could occur due to collapsed pipes or failed outfall structures.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Continue to extend utility component life until a high failure rate justifies replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		245	254	263	270	278	Ongoing	1,310
Construction		2,309	2,374	2,453	2,521	2,598	Ongoing	12,255
Total Project Cost	**0**	**2,554**	**2,628**	**2,716**	**2,791**	**2,876**	**Ongoing**	**13,565**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**210**	**2,560**	**2,635**	**2,720**	**2,800**	**Ongoing**	**10,925†**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

†Total shown is expenditures through FY2021.

Exh. RAW/C-8

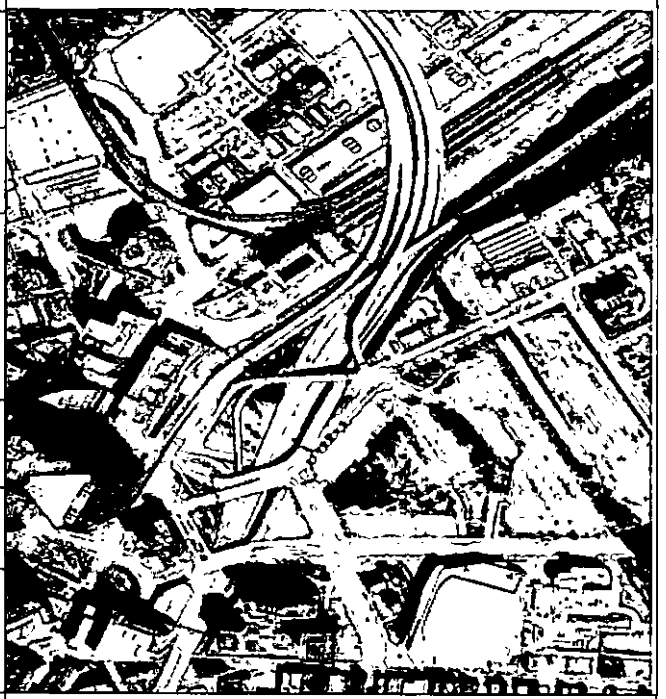
FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Stormwater System
PROJECT NAME 11th Street Storm Relief Sewer
PROJECT NO. Unassigned

STATUS Not Started

PRIORITY Regulatory Compliance, Reliability/Operational Flexibility, Capacity, Regional Cooperation/ Stewardship, Level of Service

NEIGHBORHOOD/WARD
Strip District/2 and Crawford-Roberts/3



PROJECT DESCRIPTION
Extension of dedicated storm sewer on 11th Street from Washington Place to the Allegheny River.

PROJECT JUSTIFICATION
As part of the Lower Hill Redevelopment Project and capacity issues in the Fifth Avenue system, separate storm sewers were constructed to reroute and convey rainwater from this area, but were reconnected into the combined system at Washington Place and Centre Avenue. To complete the separation and ultimately reduce combined sewer overflows, this last phase of work is required.

RISK(S)
Combined sewer overflows will continue to occur due to limited capacity of the existing mains.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Increase capacity of the combined sewer trunk sewers or evaluate the suitability and effectiveness of green infrastructure for this sewershed.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design							2,250	2,250
Construction							14,030	14,030
Total Project Cost	**0**	**0**	**0**	**0**	**0**	**0**	**16,280**	**16,280**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**0**	**0**	**16,280**	**16,280**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS Stormwater System
PROJECT NAME Maytide Storm System Improvements
PROJECT NO. Unassigned

NEIGHBORHOOD/WARD
Carrick/29

STATUS Not Started

PRIORITY Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service



PROJECT DESCRIPTION
Reconstruction of storm infrastructure from Merritt Avenue to the storm interceptor on Ravilla Avenue and the realignment of the 10-inch sanitary sewer on Maytide (Sanderson to Valline).

PROJECT JUSTIFICATION
Localized property and street flooding has been well-documented for several years at this location and the undeveloped right-of-way of Sanderson has significantly deteriorated. Additionally, an inspection of the 10-inch sanitary sewer on Maytide Street revealed structural and construction defects.

RISK(S)
Continual degradation to a steep slope could result in property damage and an increased cost to stabilize. Customers may be subject to basement backups or overflows may occur due to collapsed pipes.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
There are no practical alternatives to the recommended action.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design							320	320
Construction							1,420	1,420
Total Project Cost	**0**	**0**	**0**	**0**	**0**	**0**	**1,740**	**1,740**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1,740**	**1,740**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

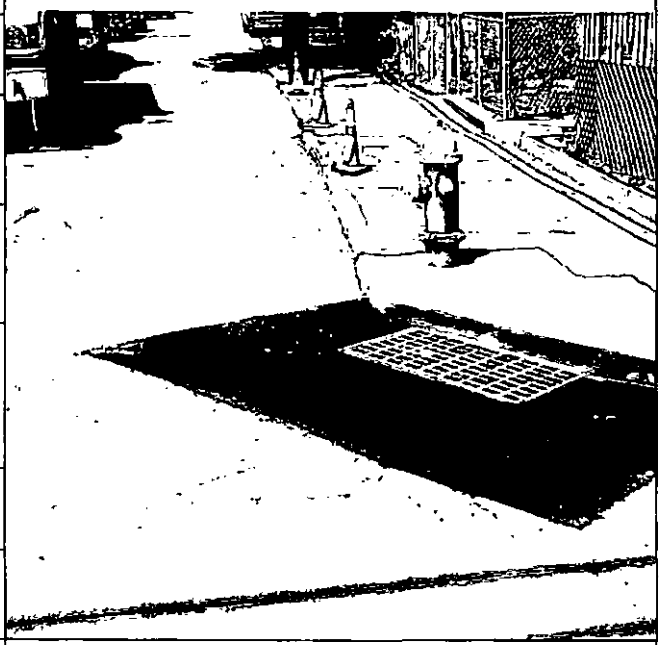
** Includes contingencies.

Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Stormwater System		
PROJECT NAME	Catch Basin and Inlet Replacement		
PROJECT NO.	Annual		
STATUS	Construction	**PRIORITY**	Safety, Regulatory Compliance, Reliability/Operational Flexibility, Level of Service

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Strategic replacement of catch basins and storm inlets throughout the system to replace failed units, stormwater control reliability, and minimize disturbance to the community.

PROJECT JUSTIFICATION
By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.

RISK(S)
Overland and street flooding could occur due to a defective or undersized catch basin or storm inlet, creating a public health and safety hazard during wet weather events. Exposes Authority to potential fines and penalties for not meeting the annual requirements listed in the Minimum Control Measures under the NPDES permit.

IMPACT ON OPERATIONS
Increased operating reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Continue to extend utility component life until a high failure rate justifies replacement.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		25	25	25	25	25	Ongoing	125
Construction	1,299	3,550	3,665	3,777	3,890	4,002	Ongoing	20,183
Total Project Cost	**1,299**	**3,575**	**3,690**	**3,802**	**3,915**	**4,027**	**Ongoing**	**20,308**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**425**	**2,023**	**3,610**	**3,730**	**3,840**	**3,950**	**Ongoing**	**17,578⁺**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☐Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

⁺Total shown is expenditures through FY2021.

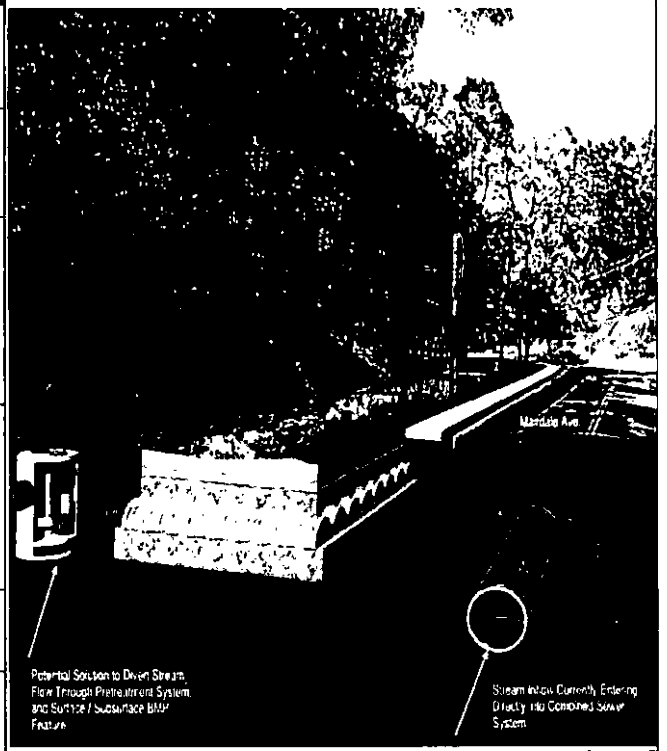
Exh. RAW/C-8

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Green Infrastructure
PROJECT NAME	City-Wide Green Infrastructure Projects
PROJECT NO.	Various

STATUS	Design	**PRIORITY**	Regulatory Compliance, Capacity, Regional Cooperation/Stewardship, Level of Service, Sustainability

NEIGHBORHOOD/WARD
Systemwide



PROJECT DESCRIPTION
Projects will be identified, designed, constructed, monitored, and evaluated for compliance with PADEP and USEPA Source Reduction strategies. The current list of projects to be constructed for is attached hereto.

PROJECT JUSTIFICATION
At the request of the office of the Mayor of the City of Pittsburgh, William Peduto, the Authority has been tasked with evaluating the benefits of incorporating extensive and hydraulically/cost-effective green infrastructure (GI) throughout the entire City of Pittsburgh to reduce the peak and sustained stormwater flows to the existing combined sewer system.

RISK(S)
Significant capital expenditures in gray infrastructure required to meet Combined Sewer Overflow (CSO) reductions, in addition to the abatement of localized basement backups and street flooding. In addition, the speed at which the project needs to be designed, constructed, monitored, and documented for the regulators' acceptance and acknowledged CSO reduction and to meet the City's deadlines.

IMPACT ON OPERATIONS
Ongoing maintenance of any recommended Best Management Practices (BMP) green facilities.

ALTERNATIVES TO THE RECOMMENDED ACTION
Implement gray infrastructure outlined in the Authority's Wet Weather Feasibility Study.

COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								
Design	188	3,475	6,000	6,000	6,000	6,000	Ongoing	27,663
Construction	751	1,940	14,000	14,000	14,000	14,000	Ongoing	58,691
Total Project Cost	**939**	**5,415**	**20,000**	**20,000**	**20,000**	**20,000**	**Ongoing**	**86,354**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**400**	**5,500**	**14,000**	**14,000**	**14,000**	**14,000**	**Ongoing**	**61,900**

FUNDING SOURCE(S)

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☒Cost Share
☐Other

Exh. RAW/C-8

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

FY 2017 to 2021 Capital Improvement Plan

GREEN INFRASTRUCTURE PROJECTS								
PROJECT NAME	PROJECT DESCRIPTION	COMMITMENT SCHEDULE* (000's)						
		Pre 2017	2017	2018	2019	2020	2021	TOTAL
Centre and Herron	Project is located in the Hill District neighborhood of the City of Pittsburgh is tributary to the M-19 outfall and will capture and direct impervious road and sidewalk runoff through a curb cut into a bioswale feature with subsurface storage. The bioswale will receive flow contribution from a 0.93 impervious acres area, with an overall 3.54 acre area drainage area.	94	689	0	0	0	0	783
Hillcrest Street	Project is located in the Garfield neighborhood of the City of Pittsburgh and is tributary to the A-22 outfall. This project will direct stormwater from downspouts as well as runoff from roadways and sidewalks into a vacant City of Pittsburgh owned parcel. The 0.25 acre parcel will be a visible asset to the community with landscaping and a walkway through the parcel. Surface and subsurface storage will be built into the project site, effectively handling 1.6 acres of impervious surface from the surrounding area.	167	819	0	0	0	0	986
Lawn and Ophelia Parks	Project is located in the South Oakland neighborhood in the City of Pittsburgh and is tributary to the M-19B outfall. This project is intended to be a community gathering space combined with stormwater management features. It is anticipated that 1.9 impervious acres from neighboring roads and roofs can be managed.	0	160	685	0	0	0	845
Maryland Avenue	Project is located in the Shadyside neighborhood in the City of Pittsburgh and is tributary to the A-22 outfall. This project will consist of distributed GI systems in four targeted areas.	0	910	5,125	140	0	0	6,175

FY 2017 to 2021 Capital Improvement Plan

GREEN INFRASTRUCTURE PROJECTS								
PROJECT NAME	PROJECT DESCRIPTION	COMMITMENT SCHEDULE ($000's)						
		Pre 2017	2017	2018	2019	2020	2021	TOTAL
McKinley Park	Project is located in the Beltzhoover neighborhood in the City of Pittsburgh and is tributary to the S-29 outfall in the Saw Mill Run Basin. This project is intended to be a community gathering space combined with stormwater management features.	0	300	0	0	0	0	300
Mellon Terrace	Project is located in the Highland Park neighborhood of the City of Pittsburgh and is tributary to the A-41 outfall. It is anticipated that 2.8 impervious acres can be managed.	0	0	0	0	230	1,010	1,240
Melwood Avenue	Project is located in the Polish Hill neighborhood of the City of Pittsburgh and is tributary to the A-22 outfall. Runoff from the adjacent streets of Melwood Avenue, Cargill Street, and Bethoven Street will be captured and managed by roadside bioretention features located in the public right of way. It is anticipated that 1.4 impervious acres from these adjacent roads will be captured and managed through the bioswale features.	158	847	0	0	0	0	1,005
Poplar and Kearns	Project is located in Green Tree Borough and is tributary to the C-25 sewershed and includes the installation of 600 linear feet of 30-inch diameter dedicated storm sewer on Popular Street.	0	600	0	0	0	0	600
Saline Street	Project is located in the Greenfield and Squirrel Hill South neighborhoods of the City of Pittsburgh and is tributary to the M-29 outfall. It is anticipated that 3.0 impervious acres from neighboring roads can be managed.	0	245	1,080	0	0	0	1,325

FY 2017 to 2021 Capital Improvement Plan

GREEN INFRASTRUCTURE PROJECTS								
PROJECT NAME	PROJECT DESCRIPTION	COMMITMENT SCHEDULE* ($000's)						
		Pre 2017	2017	2018	2019	2020	2021	TOTAL
Shamrock Way	Project is located in the Garfield neighborhood in the City of Pittsburgh and is tributary to the A-22 outfall. Runoff from adjacent streets will be captured and managed on 10 contiguous vacant lots. It is anticipated that 3.4 impervious acres from neighboring roads can be managed.	0	290	1,220	0	0	0	1,510
Volunteer's Field	Project is located in the Carrick neighborhood of the City of Pittsburgh and is tributary to Saw Mill Run. Installation of GI BMPs within the Park to reduce sediment and other pollutant loads along with stormwater volume and peak flow reduction.	0	120	500	0	0	0	620
Washington Boulevard	To be determined.	300	TBD	TBD	TBD	TBD	TBD	TBD
Wightman Park	Project is located in the Squirrel Hill neighborhood of the City of Pittsburgh and is tributary to the M-29 outfall. Stormwater management within the park itself as well as the necessary piping or inlet work to direct up to 3.25 impervious acres from the adjacent streets into the park. The Wightman Park project along with future street bioswale projects are expected to increase the impervious acres captured as well as alleviate reported sewer basement backups in the neighborhood around Wightman Park.	0	270	1,200	0	0	0	1,470
Woods Run Stream Removal – Phase 1	This project will redirect an existing stream inflow location into a detain and slow release subsurface storage facility. The stream base and wet weather flow currently discharge directly into the 36-inch diameter PWSA combined sewer on Mairdale Avenue.	0	330	1,460	0	0	0	1,790

TBD = To Be Determined

FY 2017 to 2021 Capital Improvement Plan

PROJECT CLASS	Miscellaneous
PROJECT NAME	Utility Cost Shares
PROJECT NO.	Unassigned
STATUS	Construction
PRIORITY	Regional Cooperation/Stewardship

PROJECT DESCRIPTION
Funding for infrastructure replacement due to coordination with other agencies or utilities.

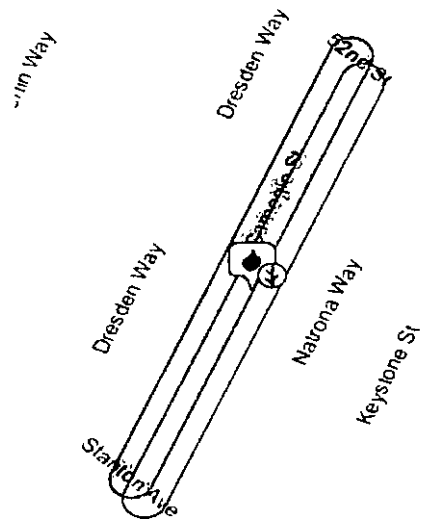
PROJECT JUSTIFICATION
Coordination with other utililties can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.

RISK(S)
If infrastructure fails in a public roadway within the duration of the Department of Public Work's pavement moratorium, the Authority will be required to restore the roadway surface curb to curb.

IMPACT ON OPERATIONS
Increase reliability.

ALTERNATIVES TO THE RECOMMENDED ACTION
Accepting the present condition of the infrastructure.

NEIGHBORHOOD/WARD
Systemwide



COMMITMENT SCHEDULE* (000's)

Phase	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Assessment/Study								0
Design		600	600	600	600	600	Ongoing	3,000
Construction		2,400	2,400	2,400	2,400	2,400	Ongoing	12,000
Total Project Cost	**0**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**Ongoing**	**15,000**

CASH FLOW SUMMARY (000's)**

	Pre 2017	2017	2018	2019	2020	2021	Post 2021	Total
Total	**0**	**600**	**3,000**	**3,000**	**3,000**	**3,000**	**Ongoing**	**10,200+**

FUNDING SOURCE

☒Capital
☐Expense: ☐Engineering ☐Sewer ☐Water
☒Cost Share
☐Other

*Concept level costs based on previous reports, Capital Improvement Plans developed by others, or similar type projects.

**Includes contingencies.

+Total shown is expenditures through FY2021.

Exh. RAW/C-8

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	Total Commitment (Budget)	Prior 2019[2]	FY 2019	FY 2020	2021 +
Water Treatment Plant					
Aspinwall and MFP Fiberglass Reinforced Plastic Chemical Tank Inspections and Repairs/Replacement	$ 295,000	$ 181,919	$ 113,081	$ -	$ -
Aspinwall WTP Raw Water Intakes	$ 45,000,000	$ -	$ 1,157,616	$ 2,506,666	$ 41,335,718
Water Treatment Plant Roof Replacement	$ 460,000	$ 207,922	$ 252,078	$ -	$ -
Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Improvements	$ 27,310,000	$ 1,147,484	$ 4,828,612	$ 7,330,290	$ 14,003,614
Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	$ 26,520,000	$ 631,735	$ 973,029	$ 1,342,659	$ 23,572,577
Clearwell Emergency Response Project	$ 27,670,000	$ 960,007	$ 528,248	$ 727,938	$ 25,453,807
Corrosion Control Chemical Storage & Feed Systems[4]	$ 4,445,000	$ 939,551	$ 3,505,449	$ -	$ -
Filter Rehab	$ -	$ -	$ 256,603	$ -	$ -
Highland Park Membrane Filtration Plant UV System[1]	$ 5,855,000	$ 2,102,537	$ 3,752,463	$ -	$ -
MFP Assessment and Critical Process Improvements[4]	$ 1,755,500	$ 1,573,405	$ 182,095	$ -	$ -
Total Water Treatment Plant	**$ 139,310,500**	**$ 7,744,560**	**$ 15,549,274**	**$ 11,907,553**	**$ 104,365,716**
Water Pumping and Storage					
Ross Pump Station	$ 43,000,000	$ -	$ 1,143,093	$ 2,406,666	$ 39,450,241
Clearwell Improvements	$ 67,810,000	$ -	$ 747,656	$ 3,159,375	$ 63,902,969
Aspinwall Pump Station to Lanpher Reservoir Rising Main	$ 49,454,000	$ 14,080	$ 1,378,729	$ 3,192,229	$ 44,868,962
Bruecken Pump Station Valve Vault[4]	$ 6,104,425	$ 5,954,144	$ 150,281	$ -	$ -
Aspinwall Water Treatment Plant High Service Pumping	$ 53,620,000	$ -	$ 4,164,254	$ 2,794,262	$ 46,661,484
Chlorine Booster Station Improvements	$ 10,090,000	$ -	$ 488,378	$ 966,757	$ 8,634,865
Highland Reservoir Pump Station and Rising Main	$ 37,130,000	$ 866,279	$ 1,893,934	$ 4,934,310	$ 29,435,477
Lanpher Reservoir Improvements[4]	$ 29,643,000	$ 7,506,095	$ 10,968,510	$ 11,168,395	$ -
Highland No. 2 Reservoir Improvements	$ 27,510,000	$ -	$ 2,936,216	$ 5,949,893	$ 18,623,891
Herron Hill Reservoir Improvements	$ 5,520,000	$ -	$ 636,559	$ 2,272,172	$ 2,611,269
Garfield Tank Improvements	$ 4,050,000	$ -	$ 32,353	$ 528,235	$ 3,489,412
Lincoln Tank Improvements	$ 4,195,000	$ -	$ 319,020	$ 1,215,910	$ 2,660,070
4	$ 23,550,000	$ -	$ 878,333	$ 2,324,166	$ 20,347,501
2020 Large Diameter Water Main Improvements	$ 11,940,000	$ -	$ 684,242	$ 1,261,591	$ 9,994,167
Total Water Pumping and Storage	**$ 373,616,425**	**$ 14,340,597**	**$ 26,421,559**	**$ 42,173,961**	**$ 290,680,308**
Water Distribution System					
Lead Service Line Replacement	$ 92,428,403	$ 15,723,862	$ 43,706,515	$ 21,085,096	$ -
2018 Lead Service Line Replacement[4]	*$ 43,300,000*	*$ 15,723,862*	*$ 14,960,534*	*$ 702,674*	$ -
2019 Lead Service Line Replacement[5]	*$ 49,128,403*	*$ -*	*$ 28,745,981*	*$ 20,382,422*	$ -
Small Diameter Water Main Replacement	$ 75,900,000	$ 801,905	$ 7,002,794	$ 21,337,448	$ 46,757,853
2018 Small Water Main Replacement	*$ 10,680,000*	*$ 801,905*	*$ 3,332,592*	*$ 5,511,769*	*$ 1,033,734*
2019 Small Water Main Replacement	*$ 10,880,000*	*$ -*	*$ 1,369,091*	*$ 4,924,742*	*$ 4,586,167*

	Total Commitment (Budget)	Prior 2019[2]	FY 2019	FY 2020	2021 +
2020 Small Water Main Replacement	*$ 54,340,000*	*$ -*	*$ 2,301,111*	*$ 10,900,937*	*$ 41,137,952*
Curb Box Inspections	$ 6,940,134	$ 1,909,241	$ 3,485,011	$ 1,545,882	$ -
2018 Curb Box Inspections	*$ 2,980,134*	*$ 1,909,241*	*$ 1,070,893*	*$ -*	*$ -*
2019 Curb Box Inspections	*$ 3,960,000*	*$ -*	*$ 2,414,118*	*$ 1,545,882*	*$ -*
Water Relay	$ 3,370,000	$ 32,308	$ 1,559,999	$ 1,617,193	$ 160,500
2018 Water Relay	*$ 1,620,000*	*$ 32,308*	*$ 1,466,691*	*$ 121,001*	*$ -*
2019 Water Relay	*$ 1,750,000*	*$ -*	*$ 93,308*	*$ 1,496,192*	*$ 160,500*
Valve Replacement	$ 8,923,380	$ 1,710,764	$ 4,579,358	$ 2,633,258	$ -
2017 Valve Replacement	*$ 2,358,380*	*$ 1,710,764*	*$ 647,616*	*$ -*	*$ -*
2019 Valve Replacement	*$ 6,565,000*	*$ -*	*$ 3,931,742*	*$ 2,633,258*	*$ -*
Hydrant Replacement	$ 2,505,438	$ 793,713	$ 1,179,945	$ 531,780	$ -
2017 Hydrant Replacement	*$ 1,170,438*	*$ 793,713*	*$ 376,725*	*$ -*	*$ -*
2019 Hydrant Replacement	*$ 1,335,000*	*$ -*	*$ 803,220*	*$ 531,780*	*$ -*
Small Meter Replacement	$ 4,349,060	$ 1,094,966	$ 2,554,094	$ 700,000	$ -
2018 Small Meter Replacement	*$ 2,249,060*	*$ 1,094,966*	*$ 1,154,094*	*$ -*	*$ -*
2019 Small Meter Replacement	*$ 2,100,000*	*$ -*	*$ 1,400,000*	*$ 700,000*	*$ -*
Large Meter Replacement	$ 2,100,000	$ -	$ 1,400,000	$ 700,000	$ -
2019 Large Meter Replacement	*$ 2,100,000*	*$ -*	*$ 1,400,000*	*$ 700,000*	*$ -*
Unmetered and Flat Rate Properties	$ 4,840,000	$ -	$ 345,000	$ 2,792,476	$ 1,702,524
2019 Unmetered and Flat Rate Properties	*$ 4,840,000*	*$ -*	*$ 345,000*	*$ 2,792,476*	*$ 1,702,524*
Low Pressure Area Remediation	$ 2,800,000	$ -	$ 406,642	$ 1,029,259	$ 1,364,099
Washout Disconnection	$ 13,140,000	$ -	$ 764,167	$ 2,018,079	$ 10,357,754
District Water and Pressure Meters	$ 2,705,000	$ -	$ 116,667	$ 1,616,143	$ 972,190
Ft. Duquesne Bridge Water Air Release Valve Repair	$ 2,850,000	$ 233,805	$ 2,338,861	$ 277,334	$ -
Total Water Distribution System	**$ 222,851,416**	**$ 22,300,564**	**$ 69,439,053**	**$ 57,883,948**	**$ 61,314,920**

	Total Commitment (Budget)	Prior 2019[2]	FY 2019	FY 2020	2021 +
Wastewater System					
Small Diameter Sewer Rehabilitation	$ 20,670,000	$ 11,058	$ 2,533,959	$ 14,519,654	$ 3,605,329
2018 Small Diameter Sewer Rehabilitatior	*$ 1,910,000*	*$ 3,750*	*$ 1,095,305*	*$ 810,945*	*$ -*
2019 Small Diameter Sewer Rehabilitatior	*$ 9,260,000*	*$ 7,308*	*$ 817,692*	*$ 7,666,859*	*$ 768,141*
2020 Small Diameter Sewer Rehabilitatior	*$ 9,500,000*	*$ -*	*$ 620,962*	*$ 6,041,850*	*$ 2,837,188*
Sewers Under Structures	$ 21,200,000	$ 176,202	$ 1,332,969	$ 7,330,512	$ 12,360,317
2018 Sewers Under Structures	*$ 6,680,000*	*$ 176,202*	*$ 647,255*	*$ 3,821,179*	*$ 2,035,364*
2019 Sewers Under Structures	*$ 7,120,000*	*$ -*	*$ 641,143*	*$ 2,654,476*	*$ 3,824,381*
2020 Sewers Under Structures	*$ 7,400,000*	*$ -*	*$ 44,571*	*$ 854,857*	*$ 6,500,572*
Sewer Reconstruction	$ 3,090,000	$ 499,745	$ 2,018,167	$ 572,088	$ -
2018 Sewer Reconstruction	*$ 1,470,000*	*$ 481,888*	*$ 988,112*	*$ -*	*$ -*
2019 Sewer Reconstruction	*$ 1,620,000*	*$ 17,857*	*$ 1,030,055*	*$ 572,088*	*$ -*
Large Diameter Sewer Rehabilitation	$ 3,800,000	$ -	$ 332,000	$ 3,468,000	$ -
2020 Large Diameter Sewer Rehabilitatior	*$ 3,800,000*	*$ -*	*$ 332,000*	*$ 3,468,000*	*$ -*
2019 Wastewater System Improvements	$ 5,350,000	$ -	$ 853,333	$ 2,915,683	$ 1,580,984
31st Ward Sewer System	$ 13,730,000	$ 528,385	$ 474,538	$ 6,319,589	$ 6,407,488
Maytide Storm and Sanitary Sewer System Improvements	$ 6,520,000	$ 260,430	$ 2,281,808	$ 3,977,762	$ -
Ivyglen and Odette Sewer Reconstruction and Separation Projec	$ 1,900,000	$ 176,667	$ 1,582,000	$ 141,333	$ -
M-29 Outfall Improvements	$ 1,845,000	$ -	$ 101,061	$ 1,743,939	$ -
Total Wastewater System	**$ 78,105,000**	**$ 1,652,486**	**$ 11,509,835**	**$ 40,988,560**	**$ 23,954,118**
Stormwater System					
Catch Basin and Inlet Replacement	$ 21,712,500	$ 1,882,078	$ 8,667,154	$ 10,067,108	$ 1,096,161
2018 Catch Basin and Inlet Replacement	*$ 10,392,500*	*$ 1,882,078*	*$ 7,743,021*	*$ 767,401*	*$ -*
2019 Catch Basin and Inlet Replacement	*$ 11,320,000*	*$ -*	*$ 924,132*	*$ 9,299,707*	*$ 1,096,161*
Stormsystem Improvements	$ 7,540,000	$ 20,000	$ 411,429	$ 3,276,428	$ 3,832,143
2019 Stormsystem Improvements	*$ 3,580,000*	*$ 20,000*	*$ 390,000*	*$ 2,847,857*	*$ 322,143*
2020 Stormsystem Improvements	*$ 3,960,000*	*$ -*	*$ 21,429*	*$ 428,571*	*$ 3,510,000*
MS4 Compliance Projects	$ 1,955,000	$ -	$ 53,444	$ 283,778	$ 1,617,778
Tide Gate Installations	$ 4,500,000	$ -	$ 295,263	$ 308,684	$ 3,896,053
Overbrook Middle School Pollution and Flood Reductior	$ 6,500,000	$ -	$ 488,864	$ 4,200,647	$ 1,810,490
Volunteer's Field Storm Infrastructure	$ 1,465,000	$ -	$ 262,821	$ 1,080,410	$ 121,769
Saw Mill Run Stream Bank Restoration	$ 1,385,000	$ -	$ 232,821	$ 1,035,410	$ 116,769
Total Stormwater System	**$ 45,057,500**	**$ 1,902,078**	**$ 10,411,795**	**$ 20,252,465**	**$ 12,491,162**
Green Infrastructure					
Lawn and Ophelia	$ 785,000	$ 104,559	$ 617,941	$ 62,500	$ -
Wightman Park	$ 2,365,000	$ 293,615	$ 1,565,630	$ 505,755	$ -

	Total Commitment (Budget)	Prior 2019[2]	FY 2019	FY 2020	2021 +
Woods Run Stream Removal-Phase 1	$ 4,296,000	$ 352,521	$ 1,307,071	$ 2,636,408	$ -
EPA 308/City of Pittsburgh Source Reduction Response	$ 750,000	$ 384,928	$ 32,588	$ -	$ -
Maryland Avenue Green Infrastructure	$ 11,340,000	$ 1,167,772	$ 3,028,861	$ 2,364,205	$ 4,779,162
Four Mile Green Stormwater Infrastructure	$ 41,100,000	$ 779,959	$ 2,019,833	$ 6,673,208	$ 31,627,000
Woodland Drive Green Infrastructure	$ 1,195,000	$ -	$ 225,000	$ 970,000	$ -
Thomas and McPherson Green Infrastructure	$ 4,650,000	$ -	$ 681,296	$ 3,548,778	$ 419,926
Southside Green/Stormwater Infrastructure	$ 8,694,000	$ -	$ 661,667	$ 2,361,583	$ 5,670,750
St. Johns Green/Stormwater Infrastructure	$ 75,000	$ -	$ 75,000	$ -	$ -
Shamrock Green/Stormwater Infrastructure	$ 40,000	$ -	$ 40,000	$ -	$ -
Spring Garden Stream Removal	$ 10,710,000	$ -	$ 210,500	$ 1,409,500	$ 9,090,000
Heth's Run Green/Stormwater Infrastructure	$ 600,000	$ -	$ 337,500	$ 262,500	$ -
MLK Field Green/Stormwater Infrastructure	$ 3,402,000	$ -	$ 492,800	$ 2,635,600	$ 273,600
Homewood Park Green/Stormwater Infrastructure	$ 2,720,000	$ -	$ 458,767	$ 2,048,033	$ 213,200
Bus Rapid Transit (BRT)Green/Stormwater Infrastructure	$ 6,050,000	$ -	$ 162,647	$ 800,588	$ 5,086,765
M-29 Green/Stormwater Infrastructure	$ 1,700,000	$ -	$ 566,667	$ 1,133,333	$ -
A-42 Green/Stormwater Infrastructure	$ 1,700,000	$ -	$ 242,857	$ 485,714	$ 971,429
Total Green Infrastructure	**$ 102,172,000**	**$ 3,083,354**	**$ 12,726,624**	**$ 27,897,705**	**$ 58,131,831**
Information Management Systems					
Computerized Maintenance Management System (CMMS)	$ 10,000,000	$ -	$ 500,000	$ 3,000,000	$ 6,500,000
Geographic Information System (GIS) Upgrades and Water and Sewer Master Plans	$ 3,000,000	$ -	$ 1,500,000	$ 1,500,000	$ -
Total Information Management Systems	**$ 13,000,000**	**$ -**	**$ 2,000,000**	**$ 4,500,000**	**$ 6,500,000**

	Total Commitment (Budget)	Prior 2019[2]	FY 2019	FY 2020	2021 +
Water Distribution System and Waste/Stormwater Systems					
Smallman Street Reconstruction	$ 16,867,000	$ 5,884,343	$ 5,428,170	$ -	$ -
Utility Cost Shares	$ 3,000,000	$ -	$ 3,000,000	$ -	$ -
Long-Term Infrastructure Improvement Plan (LTIIP)	$ 1,100,000	$ 275,000	$ 825,000	$ -	$ -
Program Management Services	$ 1,000,000	$ 250,000	$ 750,000	$ -	$ -
Total Water Distribution System and Waste/Stormwater Systems	**$ 21,967,000**	**$ 6,409,343**	**$ 10,003,170**	**$ -**	**$ -**
Total Systemwide CIP	**$ 996,079,841**	**$ 57,432,983**	**$ 158,061,310**	**$ 205,604,192**	**$ 557,438,056**

[1] Pennsylvania Department of Environmental Protection Administrative Order or Consent Order Project

[2] Includes 2018 Projected Expenditures

[3] PennVest Funding Application Submitted

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2019 Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities.	Coordination with other utililties can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.	$3,000,000	Borrowed	N/A	N/A
2020 Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities.	Coordination with other utililties can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.	$3,000,000	Borrowed	N/A	N/A
2021 Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities.	Coordination with other utililties can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.	$3,000,000	Borrowed	N/A	N/A
2022 Utility Cost Shares	Infrastructure replacement due to coordination with other agencies or utilities.	Coordination with other utililties can reduce expenditures up to 75% of the total project cost and reduces the length of time that the public is inconvenienced due to construction efforts.	$3,000,000	Borrowed	N/A	N/A
CMMS (Computerized Maintenance Management System)	Acquire, install, develop, and implement a Computerized Maintenance Management System, including training staff to assist with capital investment prioritization.	The CMMS will be used by field and engineering staff to record, house, track, and identify short-term and long-term asset investment needs. A properly developed CMMS can identify efficiency imp798528]rovements, increase levels of asset renewal, and reduce operation, maintenance, and capital costs. The CMMS will communicate with the GIS system and be able to coordinate with eBuilder as well as the Authority's finance system.	$10,000,000	Borrowed	July 2019	December 2026
2018 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units, stormwater control reliability, and minimize disturbance to the community.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$10,392,500	Borrowed	August 2018	August 2019
2019 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$11,320,000	Borrowed	August 2019	August 2020
2020 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$11,660,000	Borrowed	August 2020	August 2021

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2021 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$12,030,000	Borrowed	August 2021	August 2022
2022 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$12,380,000	Borrowed	August 2022	August 2023
2023 Catch Basin and Inlet Replacement (Annual IDIQ Contract)	Strategic replacement of approximately 840 catch basins and storm inlets throughout the system to replace failed units.	Provides increase in stormwater control reliability, minimizes disturbance to the community, and by maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$12,720,000	Borrowed	August 2023	August 2024
MS4 Compliance Projects	Four stormwater BMP projects that will reduce pollutants to impaired waters, which include stream restoration and inlet inserts at various sites.	These projects are required to comply with the MS4 NPDES permit application submitted to the Pennsylvania Department of Environmental Protection.	$1,955,000	Borrowed	October 2018	August 2020
Saw Mill Run MS4 & CSO Compliance Projects	Multiple projects that will reduce pollutants to impaired waters and reduce CSO volume, which includes stream restoration, green stormwater infrastructure, and other BMPs at various sites.	These projects are required to comply with the MS4 NPDES permit application submitted to the Pennsylvania Department of Environmental Protection and to meet the waste load reductions required in the EPA-approved Sediment TMDL in the Saw Mill Run watershed. Project also required to address PADEP Consent Order for CSO compliance.	$8,500,000	Borrowed	June 2021	December 2023
Maytide Storm and Sanitary Sewer System Improvements	Reconstruction of storm infrastructure from Merritt Avenue to the storm interceptor on Ravilla Avenue, the realignment of the sanitary sewer on Maytide (Sanderson to Valline), and the rehabilitation and/or reconstruction of the sanitary sewer mains on the undeveloped right-of-ways in the vicinity. .	Localized property and street flooding has been well-documented for several years at this location and the undeveloped right-of-way of Sanderson has significantly deteriorated. Additionally, inspections of the sanitary sewers in the vicinity revealed structural and construction defects	$6,520,000	Borrowed	March 2018	March 2020
2019 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$3,580,000	Borrowed	June 2019	July 2020
2020 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost	$3,960,000	Borrowed	August 2019	July 2021

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2021 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost	$4,045,000	Borrowed	August 2020	July 2022
2022 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost	$4,230,000	Borrowed	August 2021	July 2023
2023 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost	$4,375,000	Borrowed	August 2022	July 2024
2024 Storm System Improvements	Strategic replacement or rehabilitation of storm mains or structures to improve system reliability and minimize disturbance to the community, including reducing flooding.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost	$4,490,000	Borrowed	August 2023	July 2025
Saw Mill Run Stream Bank Restoration	Stream restoration of approximately 1,500 linear feet of the Saw Mill Run Creeks to reduce pollutants in the impaired waterway.	This project is required to comply with the MS4 NPDES permit application submitted to the Pennsylvania Department of Environmental Protection and to meet the waste load reductions required in the EPA-approved Sediment TMDL in the Saw Mill Run watershed.	$1,385,000	Borrowed	October 2018	December 2019
Volunteer's Field Storm Water Management	Installation of BMPs to reduce sediment, other pollutant loads, stormwater volume, and peak flows to the Saw Mill Run watershed.	This project is required to comply with the MS4 NPDES permit application submitted to the Pennsylvania Department of Environmental Protection and to meet the waste load reductions required in the EPA-approved Sediment TMDL in the Saw Mill Run watershed.	$1,465,000	Borrowed	October 2018	December 2019
Saw Mill Run Watershed Water Quality Improvement Project (formally known as Overbrook Pollution and Flood Reduction)	Implementation of stormwater treatment and reconnection of streams to vegetated floodplains to help mitigate stormwater peak flows, reduce flooding, reduce sediment, other pollutant loads, and reduce CSO volume	This project will demonstrate the effectiveness of green infrastructure in reducing pollutants, controlling CSO/SSOs, and restoring the health of the aquatic ecosystems in the Saw Mill Run watershed to comply with MS4 NPDES permit and PADEP CO regulatory obligations.	$6,500,000	Borrowed	May 2019	June 2021
Tide Gate Installations	Installation of tide gates at 44 combined sewer overflow diversion chamber locations to assist in preventing river water intrusion. Construction for this project is anticipated to occur in multiple phases.	This project is required to reduce CSO volume to address PADEP Consent Order for CSO compliance. Project to be completed in multiple phases and construction contracts.	$4,500,000	Borrowed	May 2019	June 2023
EPA 308/City of Pittsburgh Source Reduction Response	Modeling of the remaining priority combined sewersheds within the City of Pittsburgh, as well as the separate sewersheds within the City in order to meet an EPA submission requirements.	This project is required to comply with regulatory obligations.	$750,000	Borrowed	June 2017	December 2019

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Wightman Park Green Infrastructure	Installation of stormwater management features to capture and detain impervious acres from the adjacent streets into the park in the Squirrel Hill neighborhood of the City of Pittsburgh, which is tributary to the M-29 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$2,365,000	Borrowed	March 2018	September 2020
Woods Run Stream Removal -Phase 1	Installation of stormwater management features to detain and slow release the existing stream base and wet weather flow currently discharging directly into a 36-inch diameter combined sewer on Mairdale Avenue.	This project area was identified in the PWSA Green First Plan as a stream inflow point to the combined sewer system for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$4,296,000	Borrowed	October 2017	June 2020
Woods Run Stream Removal -Phase 2		This project area was identified in the PWSA Green First Plan as a stream inflow point to the combined sewer system for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$2,405,000	Borrowed		
Woods Run Stream Removal -Phase 3		This project area was identified in the PWSA Green First Plan as a stream inflow point to the combined sewer system for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$3,775,000	Borrowed		
Panther Hollow/Four Mile Green/Stormwater Infrastructure	Sewer separation, stream restoration, stream daylighting, bioretention, and underground storage to remove the existing stream base and wet weather flow currently discharging into the combined sewer located in M-29.	This project area was identified in the PWSA Green First Plan as a stream inflow point to the combined sewer system for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$41,100,000	Borrowed	May 2018	August 2021
Spring Garden Stream Removal	Sewer separation, stream restoration, bioretention, and underground storage (if necessary) to remove the existing stream base and wet weather flow currently discharging into the combined sewer located in A-60.	This project area was identified in the PWSA Green First Plan as a stream inflow point to the combined sewer system for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$10,710,000	Borrowed	April 2019	July 2021
MLK Field Green Infrastructure	Installation of stormwater management features to capture and detain impervious acres from the adjacent streets into the park in the Hill District/Uptown area of the City of Pittsburgh, which is tributary to the M-19 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$3,402,000	Borrowed	March 2019	September 2020

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Woodland Drive Green Infrastructure	Installation of stormwater management features to capture and detain impervious acres from the adjacent streets and steeply sloping hillside within Chatham University, which is Tributary to the A-22 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$1,195,000	Borrowed	October 2018	November 2019
Thomas and McPherson Green Infrastructure	Installation of roadside bioretention features to capture and detain impervious road runoff in the North Point Breeze neighborhood of the City of Pittsburgh, which is tributary to the A-42 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$4,650,000	Borrowed	October 2018	September 2020
Homewood Park Green/Stormwater Infrastructure	Installation of stormwater management features to capture and detain impervious acres from the adjacent streets into the park in the City of Pittsburgh, which is tributary to the M-29 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$2,720,000	Borrowed	April 2019	October 2020
Bus Rapid Transit (BRT) Green Stormwater Infrastructure	Installation of stormwater management features to capture and detain impervious acres from 5th Avenue and Forbes Ave in the City of Pittsburgh, which is tributary to multiple CSO outfalls. Project being coordinated with and constructed in phases with City road reconstruction project of 5th Avenue and Forbes Ave.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$6,050,000	Borrowed	January 2020	December 2022
Negley Run/Washington Boulevard Green Stormwater Infrastructure	Sewer separation, stream restoration, bioretention, and underground storage (if necessary) to remove the existing stream base and wet weather flow currently discharging into the combined sewer located in A-42.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$15,390,000	Borrowed	January 2019	January 2020
Lawn and Ophelia Green Infrastructure	Installation of stormwater management features to capture and detain impervious acres from the adjacent streets into the park in the South Oakland neighborhood, which is tributary to the M-19B combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$785,000	Borrowed	May 2018	November 2019
South Side Green/Stormwater Infrastructure	Installation of stormwater management features to detain and slow release the existing stream base and wet weather flow currently within the Park and downstream adjacent streets tributary to the M-16 combined sewer outfall.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$8,694,000	Borrowed	December 2018	July 2021
Maryland Avenue Green Infrastructure	Installation of stormwater management features to capture and detain impervious acres from Maryland Ave and the adjacent streets which is tributary to the A-22 combined sewer outfall. Project being split into 3 primary phases.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$9,384,000	Borrowed	January 2018	September 2021

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Shamrock Way Green/Stormwater Infrastructure	Preliminary design of stormwater management features to capture and detain impervious acres from Shamrock Way and the adjacent streets which is tributary to the A-22 combined sewer outfall. Design and construction will be through a future project to be developed after preliminary design is complete.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$40,000	Borrowed		
St. Johns Green/Stormwater Infrastructure	Preliminary design of stormwater management features to capture and detain impervious acres tributary to the former St. John's hospital site now scheduled to be green space, which is tributary to the O-27 combined sewer outfall. Design and construction will be through a future project to be developed after preliminary design is complete.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$75,000	Borrowed	December 2018	September 2020
Heth's Run/A-41 Green/Stormwater Infrastructure	Preliminary design of stormwater management features to capture and detain impervious acres within the identified high yield stormwater capture areas of the A-41 CSO sewershed. Design and construction will be through multiple future projects to be developed after preliminary design is complete.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$600.000	Borrowed	May 2019	January 2020
M-29 Green/Stormwater Infrastructure	Preliminary design of stormwater management features to capture and detain impervious acres within the identified high yield stormwater capture areas of the M-29 CSO sewershed. Design and construction will be through multiple future projects to be developed after preliminary design is complete.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$1,700,000	Borrowed	April 2019	December 2019
A-42 Green/Stormwater Infrastructure	Preliminary design of stormwater management features to capture and detain impervious acres within the identified high yield stormwater capture areas of the A-42 CSO sewershed. Design and construction will be through multiple future projects to be developed after preliminary design is complete.	This project area was identified in the PWSA Green First Plan as a high yield drainage area for capturing stormwater runoff to reduce CSO and mitigate flooding to comply with PADEP Consent Order regulatory obligations for CSO compliance.	$1,700,000	Borrowed	April 2019	December 2019
Smallman Street Reconstruction	The installation of approximately 2,500 linear feet of new storm sewer piping ranging in size from 24-inch to 54-inch, 2,000 linear feet of new sanitary sewer piping ranging in size from 18-inch to 48-inch, 2,000 linear feet of new 12-inch water main, and 1,500 linear feet of new 36-inch water transmission main.	Sewer separation and water main replacement due to the redevelopment of the Produce Terminal Building, realignment of the streetscape, and the location of the existing combined sewer infrastructure, which is located under the existing building.	$16,867,000	Borrowed	September 2017	May 2019
Sewer Master Plan	Comprehensive plan of the sewer system, including risked based prioritization for internal inspection purposes and assessment of the four pump stations.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$500,000	Borrowed	March 2019	September 2019
2018 Sewer Reconstruction (Annual IDIQ Contract)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,470,000	Borrowed	January 2018	March 2019
2019 Sewer Reconstruction (Annual IDIQ Contract)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,620,000	Borrowed	March 2019	March 2020
2020 Sewer Reconstruction (Annual IDIQ Contract)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,750,000	Borrowed	March 2020	March 2021
2021 Sewer Reconstruction (Annual IDIQ	Reconstruction of existing sewers, manholes, catch basins, and	The existing sewer system is aging and immediate	$1,750,000	Borrowed	March 2021	March 2022

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Contract)	inlets due to emergency situations or pipe failures.	repairs are required to address failures that could be significant public safety hazards.				
2022 Sewer Reconstruction (Annual IDIQ Contract)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,750,000	Borrowed	March 2022	March 2023
2023 Sewer Reconstruction (Annual IDIQ Contract)	Reconstruction of existing sewers, manholes, catch basins, and inlets due to emergency situations or pipe failures.	The existing sewer system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,880,000	Borrowed	March 2023	March 2024
2018 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes. The following four sites have been identified: Ellsworth Avenue (695 linear feet of 20-inch vitrified clay, combined sewer main located 5135 Ellsworth Avenue), Oakwood Bridge (215 linear feet of 24-inch vitrified clay, combined sewer main located adjacent to the Oakwood Road Bridge), South 16th Street (700 linear feet of 20 and 24-inch vitrified clay, combined sewer main located under the Union Supply Company building, CSX railroad tracks, and the Three Rivers Heritage Trail), and Centre Avenue (575 linear feet of 15-inch vitrified clay, combined sewer main located under a 20-inch water main that serves UPMC Shadyside and a telecommunications duct bank.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$6,680,000	Borrowed	March 2018	December 2020
2019 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes. The following three sites have been identified: Flemington Street (740 linear feet of 15-inch and 20-inch vitrified clay, combined sewer main. located under 1075 Flemington Street and on an inaccesible steep slope (>35 percent) to Beechwood Boulevard), Washington Landing River Crossing (282 linear feet of 8-inch ductile iron, sanitary sewer main located under the Allegheny River), an Seaton Avenue (402 linear feet of 8-inch vitrified clay, sanitary sewer main. located under a building addition and swimming pool).	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$7,120,000	Borrowed	April 2019	June 2021
2020 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$7,400,000	Borrowed	August 2019	February 2022

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2021 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$7,415,000	Borrowed	August 2020	February 2023
2022 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$7,795,000	Borrowed	August 2021	February 2024
2023 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$8,055,000	Borrowed	August 2022	February 2025
2024 Sewers Under Structures	Rehabilitation, relocation, and abandonment, if applicable, of existing sewer infrastructure located under or adjacent to buildings, bridges, or railroads or located on steep slopes.	In recent years, there has been an increasing rate of failure of this asset type due to limited accessibility and pipe age. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost.	$8,325,000	Borrowed	August 2023	February 2026
2019 Wastewater System Improvements	Reconstruction of existing structurally deficient sewer mains on Wiese Street, Wilbur Street, Creedmoor Avenue, Ornament Way, Cooperfield Avenue, N. Sheridan Avenue, Port Way, and Swimburne Street.	Repairs were issued on previous annual contracts; however, were not performed due to utility conflicts and limited site access.	$5,350,000	Borrowed	August 2018	January 2021
2018 Sewer Rehabilitation (Annual IDIQ Contract)	Trenchless rehabilitation of less than 24-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$1,910,000	Borrowed	September 2018	September 2019
2019 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$9,260,000	Borrowed	January 2019	April 2020

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2020 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$9,500,000	Borrowed	June 2019	December 2020
2021 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$14,690,000	Borrowed	March 2020	September 2021
2022 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$17,090,000	Borrowed	March 2021	September 2022
2023 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$17,600,000	Borrowed	March 2022	September 2023
2024 Small Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 6 miles of less than 36-inch diameter sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning, pre and post construction CCTV inspections, and if necessary, excavated point repairs and manhole rehabilitation.	Provides the Authority a means to address inflow and infiltration and several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$17,820,000	Borrowed	March 2023	September 2024
2020 Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 0.5 mile of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$3,800,000	Borrowed	February 2019	May 2020
2021 Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 0.5 mile of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$4,200,000	Borrowed	January 2020	April 2021

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2022 Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 0.5 mile of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$4,310,000	Borrowed	January 2021	April 2022
2023 Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 0.5 mile of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$4,440,000	Borrowed	January 2022	April 2023
2024 Large Diameter Sewer Rehabilitation	Proactive, trenchless rehabilitation of approximately 0.5 mile of 36-inch diameter or greater sewer mains to restore structural integrity, reduce root intrusion, and reduce infiltration and inflow, includes cleaning and pre and post construction CCTV inspections.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure. This trenchless pipe renewal method eliminates disruptive digging and restoration and is cost effective.	$4,570,000	Borrowed	January 2023	April 2024
31st Ward Sewer System Improvements	Evaluation to identify and locate the source(s) of the infiltration and inflow (I/I), removal of public I/I sources, and rehabilitation/replacement of the Rogers Street and Mifflin Road Pump Station and force main. Project will be designed and constructed in a minimum of two phases to ensure the pump stations are properly sized and the flow conveyed will not negatively impact the downstream sewer subshed.	Both sewage pump stations and the force main that convey flow to the Streets Run Sanitary Trunk Sewer were constructed in the late 1940's and are reaching the end of their useful life. Additionally, studies suggest this sewershed is significantly impacted by high levels of infiltration/inflow.	$13,700,000	Borrowed	March 2017	February 2021
Larimer Avenue Sewer and 28th Street Stabilization	Evaluation of rerouting storm laterals, sewer televising, geotechnical investigations, and slope stabalization to address a structurally deficient 18-inch combined sewer that has severely eroded the ground surface on the slope below Brereton Street and above the Port Authority of Allegheny County's East Busway.	Repairs were issued on previous annual contracts; however, were not performed due to utility conflicts and limited site access.	$695,901	Borrowed	January 2018	October 2019

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Ivyglen and Odette Sewer Reconstruction and Separation Project	The installation of a new sanitary sewer and storm sewer on Odette and Ivyglen, which will eliminate the combined sewer outfall and a sewer on an unstable slope.	During the weekend of June 23, 2018, PGH2O was informed of a landslide that occurred in the hillside in rear of 2604 Ivyglen, which collapsed a manhole and potentially compromised the 8-inch sanitary sewer that exists on the slope. Considering the current steepness of the slope, the presence of Saw Mill Run at the toe of the slope, and the unknown location of the sewer, it does not appear that there is an expeditious and safe way to readily repair the sewer and/or protect the sewer from damage due to additional slope movements. Further disturbance of the slope with construction equipment could cause additional movements that could impact both the residential structure(s) at the crest and Saw Mill Run below. Additionally, the Odette Street sewer main is single combined sewer segment that overflows into the creek during wet weather events.	$1,900,000	Borrowed	July 2018	June 2019
M-29 Outfall Improvements	Structural improvements and rehabilitation of the the M-29 combined sewer outfall diversion structure. Repairs to the diversion structure include lowering of the weir wall height and safety improvements for maintenance of the structure. The outfall pipeline requires extensive repairs and installation of a new flap gate to the outfall on the Monongahela River.	Provides the Authority a means to address several moderate/major structural defects in a pipe segment prior to complete failure.	$1,845,000	Borrowed	November 2018	November 2019
2019 Hydrant Replacement (Annual IDIQ Contract)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system, excluding hydrants replaced during relays.	Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.	$1,335,000	Borrowed	January 2019	April 2020
2020 Hydrant Replacement (Annual IDIQ Contract)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system, excluding hydrants replaced during relays.	Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.	$1,430,000	Borrowed	September 2019	April 2021
2021 Hydrant Replacement (Annual IDIQ Contract)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system, excluding hydrants replaced during relays.	Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.	$1,450,000	Borrowed	September 2020	April 2022
2022 Hydrant Replacement (Annual IDIQ Contract)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system, excluding hydrants replaced during relays.	Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.	$1,450,000	Borrowed	September 2021	April 2023
2023 Hydrant Replacement (Annual IDIQ Contract)	Replacement of approximately 100 broken or older model type hydrants throughout the water distribution system, excluding hydrants replaced during relays.	Increasing the number of operational hydrants provides better fire protection for the City of Pittsburgh.	$1,575,000	Borrowed	September 2022	April 2024

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2019 Valve Replacement (Annual IDIQ Contract)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves.	Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.	$6,565,000	Borrowed	January 2019	April 2020
2020 Valve Replacement (Annual IDIQ Contract)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves.	Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.	$6,805,000	Borrowed	September 2019	April 2021
2021 Valve Replacement (Annual IDIQ Contract)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves.	Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.	$6,920,000	Borrowed	September 2020	April 2022
2022 Valve Replacement (Annual IDIQ Contract)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves.	Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.	$7,150,000	Borrowed	September 2021	April 2023
2023 Valve Replacement (Annual IDIQ Contract)	Replacement of defective or non-operational valves on transmission and distribution mains throughout the water distribution system, excluding valves replaced during relays. Includes locating, assessing and documenting the operability, raising to grade, and/or cleaning existing buried or obstructed valves.	Increasing the number of operable valves in the system will reduce the number of customers that may be impacted and the number of valves that would need to be closed during emergency conditions.	$7,400,000	Borrowed	September 2022	April 2024
2018 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,620,000	Borrowed	May 2018	September 2019
2019 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,750,000	Borrowed	June 2019	October 2020
2020 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,720,000	Borrowed	June 2020	October 2021
2021 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,750,000	Borrowed	June 2021	October 2022
2022 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,880,000	Borrowed	June 2022	October 2023

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2023 Water Relay (Annual IDIQ Contract)	Replacement of existing water mains, valves, fittings, service connections, and hydrants due to emergency situations.	The existing water distribution system is aging and immediate repairs are required to address failures that could be significant public safety hazards.	$1,880,000	Borrowed	June 2023	October 2024
2018 Small Water Main Replacement	Strategic replacement of water mains to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. In 2018, the following mains have been selected for replacement: Hamilton Avenue from N. Dallas Avenue to N. Homewood Avenue; Railroad Street from 25th Street to 32nd Street; and S. Millvale Avenue from Liberty Avenue to Friendship Avenue.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$10,680,000	Borrowed	December 2017	December 2019
2019 Small Diameter Water Main Replacement	Strategic replacement of water mains to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$10,880,000	Borrowed	FMarch 2019	December 2020
2020 Small Diameter Water Main Replacement	Strategic replacement of water mains, including lead service lines, to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$54,340,000	Borrowed	March 2019	December 2020
2021 Small Diameter Water Main Replacement	Strategic replacement of water mains, including lead service lines, to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$114,770,000	Borrowed	January 2020	December 2021

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2022 Small Diameter Water Main Replacement	Strategic replacement of water mains, including lead service lines, to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$120,060,000	Borrowed	Janurary 2021	December 2022
2023 Small Diameter Water Main Replacement	Strategic replacement of water mains, including lead service lines, to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$58,860,000	Borrowed	January 2022	December 2023
2024 Small Diameter Water Main Replacement	Strategic replacement of water mains, including lead service lines, to improve system reliability as well as improve water pressure, maintain water quality, and minimize disturbance to the community. By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality and available hydrant flows will also improve by removing tuberculated mains.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus saving in overall replacement cost. Additionally, projects will be coordinated with other utilities to minimize disturbance to the community and street surface restoration costs. Water quality will also improve by removing tuberculated mains.	$60,700,000	Borrowed	January 2023	December 2024
District Water and Pressure Meters	Installation of water meters and pressure monitors in the distribution system to determine water usage and loss, and pressure loss.	Pressure Monitors are required per PUC. District Metering will be used for water auditing and leak detection.	$2,705,000	Borrowed	January 2019	October 2020
Ft. Duquesne Bridge Water Air Release	Perform transient analysis along existing 30-inch water main that is suspended from the Fort Duquesne Bridge. Design and construct new pipe supports, couplings, and thrust restraint based on the results of the analysis. Includes the replacement of the existing air-release valve on the 30-inch water main, including insulation or heat tracing to reduce potential for freezing and cracking of the valve.	A recent PENNDOT inspection of the Fort Duquesne Bridge identified priority code 1 defects in the support of the existing 30-inch diameter water main. Additionally, the existing 2-inch diameter air-release valve located on the main has a history of failure. The water main is located below the lower deck of the Fort Duquesne Bridge and serves as an emergency interconnection between pressure gradients and is a vital component to the system operation.	$2,850,000	Borrowed	January 2017	December 2019

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Washout Disconnection	Investigation and, if necessary, disconnection of large water main washouts from the sewer system.	A number of older washouts on larger mains were directly connected to sewers with a closed valve during construction. These washouts (cross connections) must be completely disconnected from the sewer.	$13,140,000	Borrowed	October 2018	September 2023
2019 Unmetered and Flat Rate Properties	Metering unmetered and flat rate properties as required by the PUC	Ensure capture of all revenue	$4,840,000	Borrowed	March 2019	March 2020
2020 Unmetered and Flat Rate Properties	Metering unmetered and flat rate properties as required by the PUC	Ensure capture of all revenue	$4,975,000	Borrowed	March 2020	March 2021
2021 Unmetered and Flat Rate Properties	Metering unmetered and flat rate properties as required by the PUC	Ensure capture of all revenue	$5,100,000	Borrowed	March 2021	March 2022
2022 Unmetered and Flat Rate Properties	Metering unmetered and flat rate properties as required by the PUC	Ensure capture of all revenue	$5,245,000	Borrowed	March 2023	March 2024
2023 Unmetered and Flat Rate Properties	Metering unmetered and flat rate properties as required by the PUC	Ensure capture of all revenue	$5,360,000	Borrowed	March 2024	March 2025
2019 Large Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,100,000	Pay Go	December 2018	December 2019
2020 Large Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,200,000	Pay Go	December 2019	December 2020
2021 Large Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,200,000	Pay Go	December 2020	December 2021
2022 Large Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,300,000	Pay Go	December 2021	December 2022
2023 Large Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,400,000	Pay Go	December 2022	December 2023
2019 Small Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,100,000	Pay Go	December 2018	December 2019
2020 Small Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,200,000	Pay Go	December 2019	December 2020
2021 Small Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,200,000	Pay Go	December 2020	December 2021
2022 Small Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,300,000	Pay Go	December 2021	December 2022
2023 Small Water Meters	Replacement of meters as required by the PUC	Ensure capture of all revenue	$2,400,000	Pay Go	December 2022	December 2023
2018 Lead Service Line Replacement	Replacement of 7% of lead service lines, both public and private.	Due to the exceedance of the action levels from compliance tests for lead and copper, the Pennsylvania Department of Environmental Protection required the Authority to perform additional distribution system water quality monitoring, optimization of corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.	$43,300,000	Borrowed	March 2018	February 2019
2019 Lead Service Line Replacement	Replacement of 7% of lead service lines, both public and private.	Due to the exceedance of the action levels from compliance tests for lead and copper, the Pennsylvania Department of Environmental Protection required the Authority to perform additional distribution system water quality monitoring, optimization of corrosion control treatment, source water monitoring/treatment, public education, and lead service line replacement.	$49,128,403	Borrowed/Grant	October 2018	February 2020

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2018 Curb Box Inspections	Curb Box Inspections provide the Authority with a cost effective way to visually identify the material on both the public and private sides of the water service lines. Curb Boxes typically require moderate cleaning through a combination of vacuum extraction, high pressure air and high pressure water before a clear visual of the service line can be obtained.	Locating lead service lines allows the Authority to identify both individual service lines to replace and waterlines that have a particularly high amount of lead service lines that can be replaced to facilitate the lead service line replacements.	$2,980,134	Borrowed	December 2017	March 2019
2019 Curb Box Inspections	Curb Box Inspections provide the Authority with a cost effective way to visually identify the material on both the public and private sides of the water service lines. Curb Boxes typically require moderate cleaning through a combination of vacuum extraction, high pressure air and high pressure water before a clear visual of the service line can be obtained.	Locating lead service lines allows the Authority to identify both individual service lines to replace and waterlines that have a particularly high amount of lead service lines that can be replaced to facilitate the lead service line replacements.	$3,960,000	Borrowed	April 2020	March 2020
2020 Curb Box Inspections	Curb Box Inspections provide the Authority with a cost effective way to visually identify the material on both the public and private sides of the water service lines. Curb Boxes typically require moderate cleaning through a combination of vacuum extraction, high pressure air and high pressure water before a clear visual of the service line can be obtained.	Locating lead service lines allows the Authority to identify both individual service lines to replace and waterlines that have a particularly high amount of lead service lines that can be replaced to facilitate the lead service line replacements.	$3,960,000	Borrowed	February 2019	March 2021
2019 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections. In 2019, Rising Mains 3 and 4 from the Bruecken Pump Station have been selected for improvements, which is approximatly 2.3 miles of main.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Rising Mains 3 and 4 from Bruecken Pump Station to Highland 2 Reservoir were chosen for the 2019 Large Diameter Water Main Improvements Program due to their criticality when the clearwell is being rebuilt.	$23,550,000	Borrowed	February 2019	March 2022

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2020 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Mains chosen for 2020 for renewal will be based on the outcome of the Water Distribution System Master Plan.	$11,940,000	Borrowed	January 2019	August 2022
2021 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Mains chosen for 2020 for renewal will be based on the outcome of the Water Distribution System Master Plan.	$12,170,000	Borrowed	January 2020	August 2023
2022 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Mains chosen for 2020 for renewal will be based on the outcome of the Water Distribution System Master Plan.	$12,430,000	Borrowed	January 2021	August 2024

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
2023 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Mains chosen for 2020 for renewal will be based on the outcome of the Water Distribution System Master Plan.	$26,410,000	Borrowed	January 2022	August 2025
Aspinwall Pump Station to Lanpher Reservoir Rising Main	Construction of a new, redundant rising main from Aspinwall Pump Station to Lanpher Reservoir.	The existing 60-inch rising main that supplies the Lanpher Reservoir is a 150 year old riveted steel pipe, has several tap connections to critical and bulk customers, and has experienced recent pipe failures. The proposed rising main would serve as a primary supply source for Lanpher Reservoir during the Clearwell Replacement Project and a redundant supply line in case of a failure or planned cleaning and rehabilitation of the existing 60-inch supply main.	$49,454,000	Borrowed	September 2018	September 2022
Aspinwall Pump Station Improvements	Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems. The current pump station was constructed in 1914 and many of the components were installed in 1958.	The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff.	$29,690,000	Borrowed	May 2019	March 2023
Bruecken Pump Station Improvements	Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems. The pump station was constructed in 1931.	The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. This project is a critical component of the clearwell replacement project.	$24,990,000	Borrowed	April 2019	February 2023
Aspinwall Water Treatment Plant High Service Pump Station	In lieu of Aspinwall and Bruecken Pump Stations, a new high service pump station may be constructed to service Highland Reservoir 1, Highland Reservoir 2, Lanpher Reservoir, and Fox Chapel.	If this project moves forward, the Aspinwall Pump Station Imrpvements and Bruecken Pump Station Improvements Project would be reduced to only what is necessary to keep the stations operational until the new station is online. This project is a critical component of the clearwell replacement project.	$53,620,000	Borrowed	October 2018	February 2023
Ross Pump Station Improvements	Replacement of aged pump and valve equipment, meters, SCADA, electrical equipment, HVAC, and auxiliary systems and the rehabilitation of the building architectural and energy management systems.	The Ross Pump Station is the only feed to the water treatment plant. This station is in need of renewal.	$43,000,000	Borrowed	August 2018	TBD

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Chlorine Booster Station Improvements	Rehabilitation or replacement of the existing sodium hypochlorite booster stations in the distribution system, excluding Lanpher and Herron Hill. Includes installation of flow meters, if necessary.	Existing chlorine injections systems at satellite storage facilities are in need of renewal. Without upgrade of these facilities, the system would be in violation of residual chlorine levels required by PA DEP.	$10,090,000	Borrowed	December 2018	December 2021
Garfield Tank Improvements	Perform a comprehensive inspection of the existing elevated storage tank, evaluate the system's need for additional storage for regulatory compliance, the need for an additional storage tank, and rehabilitation of the existing tank. Evaluation of storage capacity will be based on outcome of the Water Distribution System Master Plan.	Renewal of storage tanks is necessary to ensure a safe and reliable water supply. Garfield Tank has been identified based on the 40-year master plan as well as recent leaks for priority for renewal. Tank size may need to be increased based on outcome of Water Distribution System Master Plan.	$4,050,000	Borrowed	September 2018	April 2021
Lincoln Tank Improvements	Perform a comprehensive inspection of the existing storage tank, evaluate the system's need for additional storage for regulatory compliance, the need for an additional tank, and rehabilitation of the existing tank. Evaluation of storage capacity will be based on outcome of the Water Distribution System Master Plan.	Renewal of storage tanks is necessary to ensure a safe and reliable water supply. Garfield Tank has been identified based on the 40-year master plan as well as recent leaks for priority for renewal. Tank size may need to be increased based on outcome of Water Distribution System Master Plan.	$4,195,000	Borrowed	September 2018	April 2021
Herron Hill Reservoir Improvements	Installation of new liner and cover and provide ancillary improvements to the entire facility, including Sodium Hypochlorite injection system, SCADA system improvements, site electrical improvements, sluice gate rehabilitation, dewatering pumps, concrete repairs and necessary site work.	Reservoir liner and cover is close to the end of its design life where patching and regular maintenance will no longer be effective.	$5,520,000	Borrowed	October 2018	December 2020
Lanpher Reservoir Improvements	Installation of new liner and cover and provide ancillary improvements to the entire facility, including Sodium Hypochlorite injection system, SCADA system improvements, site electrical improvements, sluice gate rehabilitation, dewatering pumps, concrete repairs and necessary site work.	Work required as a result of a failure of the reservoir floating cover in September 2017. Sodium hypochlorite feed system is reaching the end of its design life.	$29,643,000	Borrowed	September 2017	June 2019
Highland No. 2 Reservoir Improvements	Installation of new liner and cover and provide ancillary improvements to the entire facility, including new outlet piping for Highland Pump Station and Rising Main, Sodium Hypochlorite injection system, SCADA system improvements, site electrical improvements, sluice gate rehabilitation, dewatering pumps, concrete repairs and necessary site work.	Upgrade of outlet structure to allow increased capacity for the Highland Reservoir Pump Station. Replace liner and cover.	$27,510,000	Borrowed	March 2019	March 2022

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Highland Reservoir Pump Station and Rising Main	Construction of a new finished water pump station and transmission main to supply water to the Highland No.1 Service Area from Highland No. 2 Reservoir	All compliant water supply for the Highland No. 1 Service Area currently flows through the Highland No. 1 Reservoir and the Membrane Filtration Plant (MFP) or directly into the system. There is no online storage for the system, and there is no other source water supply for the Highland No. 1 Service Area. In addition to providing alternate supply, this project will temporarily provide finished water that meets the chlorine disinfection rules to the Highland No. 1 Service Area during the Clearwell Replacement Project. Additionally, this new facility will also be designed to service the Garfield pressure district, thus eliminating the need to rehabilitate the (New) Highland Pump Station.	$37,130,000	Borrowed	March 2017	June 2022
Aspinwall and MFP Fiberglass Reinforced Plastic Chemical Tank Inspections and Repairs/Replacement	Inspection and rehabilitation and/or replacement of the fiberglass reinforced plastic chemical tanks.		$294,000	Borrowed	April 2017	June 2019
Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Improvements	Improvements to pretreatment chemical systems, clarifiers, sedimenation, and associated systems to provide enhanced water treatment.	Chemical treatment systems are a critical component to producing safe drinking water. Components of the chemical treatment systems can no longer be operated in a safe, effective, or reliable manner to meet water quality requirements. Many bulk water treatment chemicals present safety hazards to staff. The storage and pumping systems associated with these chemicals have reached the end of their useful life. Failures resulting in dust creation and chemical spills can place operators in unsafe working conditions and can cause physical damage to equipment and structures, as well as environmental contamination.	$27,310,000	Borrowed	March 2017	February 2023
Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	Improvements to electrical systems at Aspinwall Water Treatment Plant, including provisions for backup power systems, upgrades to existing electrical distribution system, and replacement of motor control centers.	Electrical systems at the Aspinwall Water Treatment Plant have generally met the end of their useful lives and spare/replacement parts are unavailable. Electrical panels do not meet current safety standards, including lack of arc flash protection. Additionally, the Aspinwall Water Treatment Plant does not have redundant power systems or a means for stand-by power for critical pumping and treatment systems.	$26,520,000	Borrowed	March 2017	February 2023

Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Start Date	Date of Completion & In Service
Aspinwall Water Treatment Plant Raw Water Intakes	Project will include renewing or replacing the existing West and East Raw Water Intake Gate House buildings and associated systems, including gates, screens, and associated mechanical equipment as well as the addition of SCADA. Influent piping through the Ross Pump Station will also be addressed.	Only one intake is currently operable. Both intakes are in need of renewal.	$45,000,000	Borrowed	August 2018	TBD
Clearwell Emergency Response Project	Construction of piping, suction wells, if necessary, and appurtenances to bypass the existing clearwell.	This project will provide a means to bypass the existing clearwell. Note: Disinfection requirements will not be achieved while bypassing is occurring. Additionally, this infrastructure will be required to maintain water supply to PWSA's customers for the rehabilitation or replacement of the existing clearwell.	$27,670,000	Borrowed	March 2017	April 2022
Clearwell Improvements	Replacement of the existing 108 year old, single cell clearwell (finished water structure). The clearwell was constructed in 1908 and has not undergone any major modifications or upgrades since. It has two main functions: providing equalization storage that allows the filters to operate independently of potential fluctuations in system demands and providing sufficient retention contact time for disinfection to meet the requirements of the Federal Surface Water Treatment Rule and Long-Term 2 Enhanced Surface Water Treatment Rule.	Considering the age and condition of the clearwell, it is the water system's weakest link as there are no practical means to deliver water by bypassing the clearwell, while maintaining the required volume, quality, and contact time.	$67,810,000	Borrowed	April 2019	March 2024
Corrosion Control Chemical Storage and Feed Systems	Installation of phosphoric acid storage and feed systems located at Aspinwall Pump Station, Bruecken Pump Station, and near the Membrane Filtration Plant to provide corrosion control in the distribution system.	Addition of a new corrosion control chemical was required per PA DEP Consent Order.	$3,960,000	Borrowed	May 2018	March 2019
Highland Park Membrane Filtration Module Replacement Program	Replace membrane modules, which includes a total of 10 racks each with 80 modules. Note: Four racks were replaced in 2017.	Replacement necessary to maintain operation of the MFP.	$21,717,711	Borrowed	May 2017	January 2020
Highland Park Membrane Filtration Plant UV System	Installation of a UV treatment system and appurtenances at the Highland Park Membrane Filtration Plant (MFP).	To comply with the 1 log inactivation of Giardia cysts and the PADEP Administrative Order dated October 25, 2017.	$5,855,000	Borrowed	October 2017	April 2019
MFP Assessment and Critical Process Improvements	Complete a condition assessment of systems supporting the treatment process and perform critical improvements to maintain water treatment and allow full warranty of replacement modules. Improvements may include electrical, chemical feed, strainers, and other support systems.		$1,755,500	Borrowed	March 2017	December 2018
Water System GIS Improvements	Rescan Water Record Books, Input material and pipe age into GIS. Update valve layer.	GIS upgrade required in order to prioritize mains for renewal.	$1,200,000	Borrowed	May 2019	May 2021
Water Master Plan	Comprehensive plan, including analysis of demands, future demands, capacities, and pipe condition based assessment.	Master Plan required to prioritize water mains, pump stations, and storage for renewal, identify and refine future CIP projects.	$500,000	Borrowed	March 2019	October 2019
Low Pressure Area Remediation	Fix chronically low pressure areas by either extending neighboring higher pressure districts into the area, booster pump stations, or household booster pumps.	This project is in response to the low pressure monitors required by the October 2017 Administrative Order.	$2,000,000	Borrowed	January 2019	January 2021

Notes:

Required per November 17, 2017 Consent Order and Agreement with PA DEP
Required per October 25, 2017 PA DEP Administrative Order
Projects noted in October 25, 2017 PA DEP Administrative Order

1. Pressure Sensors, as required by October 25, 2017 PA DEP Administrative Order purchased under Highland Park Membrane Filtration Plant UV System.
2. Bruecken Pump Station improvements required per October 25, 2017 PA DEP Administrative Order covered under existing project, Bruecken Pump Station Improvements, not listed on this table.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

City of Pittsburgh 301 City-County Building 414 Grant Street Pittsburgh Pennsylvania 15219	:	
And	:	Violations of the Safe Drinking Water Act and the Rules and Regulations Promulgated Pursuant Thereto
Pittsburgh Water and Sewer Authority Penn Liberty Plaza 1 1200 Penn Avenue Pittsburgh, PA 15222	:	

ADMINISTRATIVE ORDER

NOW, this 25th day of October 2017, the Commonwealth of Pennsylvania, Department of Environmental Protection ("Department"), issues this Administrative Order after it has found and determined the following:

FINDINGS

A. The Department is the agency with the duty and authority to administer and enforce the Pennsylvania Safe Drinking Water Act, Act of May 1, 1984, P.L. 206, *as amended*, 35 P.S. §§ 721.1-721.17 ("Safe Drinking Water Act"); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, *as amended*, 71 P.S. § 510–17 ("Administrative Code"); and the rules and regulations promulgated thereunder ("Regulations").

B. The City of Pittsburgh ("City") is a municipality with a business address of 301 City-County Building, 414 Grant Street, Pittsburgh Pennsylvania 15219. The City is a "person" as that term is defined in Section 3 of the Safe Drinking Water Act, 35 P.S. § 721.3, and Section 109.1 of the Regulations, 25 Pa. Code § 109.1; a "supplier of water" as that term is defined in

Section 3 of the Safe Drinking Water Act, 35 P.S. § 721.3; and a "public water supplier" as that term is defined in Section 109.1 of the Regulations, 25 Pa. Code § 109.1.

C. Pittsburgh Sewer and Water Authority ("PWSA") is a municipal authority with a business address of Penn Liberty Plaza 1, 1200 Penn Avenue, Pittsburgh Pennsylvania 15222. PWSA is a "person" as that term is defined in Section 3 of the Safe Drinking Water Act, 35 P.S. § 721.3, and Section 109.1 of the Regulations, 25 Pa. Code § 109.1; a "supplier of water" as that term is defined in Section 3 of the Safe Drinking Water Act, 35 P.S. § 721.3; and a "public water supplier" as that term is defined in Section 109.1 of the Regulations, 25 Pa. Code § 109.1.

D. PWSA leases, operates, and is the permittee of a "public water system" and, more specifically, a "community water system," as those terms are defined in Section 3 of the Safe Drinking Water Act, 35 P. S. § 721.3, and Section 109.1 of the Regulations, 25 Pa. Code § 109.1. PWSA's public water system consists of water sources, storage facilities, treatment facilities, and a distribution system ("System"). PWSA provides drinking water through the System to approximately 520,000 people in the Pittsburgh, Pennsylvania area, including approximately 250,000 residential customers. PWSA operates the System pursuant to multiple public water supply permits issued by the Department, and has been assigned Public Water System Identification Number 5020038. The City owns the System and leases it to PWSA.

E. Section 109.4(3) of the Regulations, 25 Pa. Code § 109.4(3), requires that public water suppliers shall provide and effectively operate and maintain public water system facilities.

F. Section 109.4(4) of the Regulations, 25 Pa. Code § 109.4(4), requires that public water suppliers shall take whatever investigative or corrective action is necessary to assure that safe and potable water is continuously supplied to the users of the public water system.

G. Section 109.202(c)(1)(ii) of the Regulations, 25 Pa. Code § 109.202(c)(1)(ii), requires that the combined total effect of disinfection processes utilized in a filtration plant shall achieve at least 90% inactivation of Giardia cysts and 99.9% inactivation of viruses, as determined by CTs and measurement methods established by the Environmental Protection Agency ("EPA").

H. On January 31, 2017, the Department issued a Field Order requiring PWSA to issue a Boil Water Advisory to all customers served by the Highland Membrane Filtration Plant. The Department had discovered that the combined total effect of disinfection processes utilized at the Highland Membrane Filtration Plant failed to achieve at least 90% inactivation of Giardia cysts and 99.9% inactivation of viruses, as determined by CTs and measurement methods established by the EPA, in violation of 25 Pa. Code § 109.202(c)(1)(ii) and 25 Pa. Code § 109.4(3). In response to the January 31, 2017 Field Order, PWSA took the Highland Membrane Filtration Plant out of service.

I. As of the date of this Administrative Order, PWSA's Highland Membrane Filtration Plant remains out-of-service, and PWSA has not submitted a complete and technically sufficient permit application to modify the Highland Membrane Filtration Plant, in order to achieve at least 90% inactivation of Giardia cysts and 99.9% inactivation of viruses, as determined by CTs and measurement methods established by the EPA as required by 25 Pa. Code § 109.4(4).

J. On August 28, 2017, the Department issued a Field Order requiring PWSA to issue a Boil Water Advisory for all customers served by the Lanpher Reservoir after learning that the integrity of the Lanpher Reservoir floating cover system had been compromised, allowing potential pathways of contamination into the finished water. PWSA failed to effectively operate

and maintain the Lanpher Reservoir floating cover system in violation of 25 Pa. Code § 109.4(3), and failed to take the investigative or corrective actions necessary to assure that safe and potable water was continuously supplied to the users of the System, in violation of 25 Pa. Code § 109.4(4). As a result of the August 28, 2017 Field Order, PWSA took the Lanpher Reservoir out of service.

K. PWSA, as operator, and the City, as owner, have failed to effectively operate and maintain the public water system facilities of the System, in violation of 25 Pa. Code § 109.4(3), and have failed to take the investigative or corrective actions necessary to assure that safe and potable water is continuously supplied to the users of the System, in violation of 25 Pa. Code § 109.4(4).

ORDER

NOW therefore, pursuant to its authority under Sections 5 and 12 of the Safe Drinking Water Act, 35 P.S. §§ 721.5 and 721.12, and Section 1917-A of the Administrative Code, 71 P.S. § 510-17, the Department hereby Orders that:

PWSA and the City shall ensure that the System has the necessary treatment, resiliency, and reliability to maintain adequate quality, quantity, and pressure to assure that safe and potable water is continuously supplied to the users. PWSA shall undertake and complete the following tasks by the deadlines set forth below in order to resume operation of the Highland 1 Reservoir, restore the Lanpher Reservoir to service, address reliability deficiencies at the Bruecken Pump Station, and establish a schedule for other capital improvements to the System:

1. **Highland 1 Reservoir and Membrane Filtration Plant**. PWSA shall perform the actions necessary to resume operation and use of the Highland 1 Reservoir by one of the methods listed in subparagraph a. or b., below:

a. By completing the activities set forth in subparagraphs i. through viii., below, PWSA shall reinstate operation of the Highland Membrane Filtration Plant to provide a continuous supply of safe and potable water to the users, for such time as may be necessary until PWSA has provided an alternative means to do so:

i. On or before November 30, 2017, submit a complete and technically sufficient application to amend Permit No. 0298509 to provide the following:

(a) Replacement of in-line membrane strainers;

(b) Replacement of membrane filtration modules;

(c) Addition of an ultraviolet (UV) disinfection unit capable of inactivation of both Giardia and viruses with UV treatment, in conjunction with the existing chlorination system, that complies with the US EPA Ultraviolet Disinfection Guidance Manual and is validated via an EPA approved 3rd party; and

(d) Identification of all modifications to the plant recommended to PWSA by the manufacturer of the membrane filters, Pall Corporation.

ii. Within 60 days of the date the Department issues an amended construction permit, replace all in-line membrane filtration strainers according to manufacturer standards.

iii. Within 60 days of the date the Department issues an amended construction permit, replace a minimum of 4 membrane racks.

iv. Within 60 days of the date the Department issues an amended construction permit, submit a schedule to replace the remaining membrane racks.

v. On or before November 30, 2017, provide to the Department documentation that the Kinney strainers are functioning according to manufacturer standards.

vi. Within 90 days of the date the Department issues an amended construction permit, install the UV disinfection unit as approved.

vii. Notify the Department at least 48 hours prior to start-up of the Highland Membrane Filtration Plant and request a pre-operational site visit by the Department to verify that PWSA has:

(a) Completed the modifications recommended by Pall Corporation;

(b) Retained the services of adequately trained and properly certified operators to operate the membrane and UV facilities; and

(c) Complied with all conditions of the amended construction permit issued by the Department.

viii. Following start-up of the Highland Membrane Filtration Plant, PWSA shall submit to the Department each day by 9 a.m. all information contained in the Monthly Daily Integrity Pressure Decay Testing Report form and shall continue to provide daily reports until directed otherwise in writing by the Department.

b. On or before November 30, 2017, PWSA shall submit a complete application for a minor permit amendment to cover the Highland 1 reservoir. Within 150 days of the date the Department issues an amended construction permit, cover the Highland 1 reservoir in accordance with the terms and conditions of the permit, and provide adequate security with a physical barrier.

2. **Lanpher Reservoir**. PWSA shall complete all actions necessary to restore the Lanpher Reservoir to service in accordance with the following schedule:

a. On or before November 15, 2017, PWSA shall complete repairs to the cover of the Lanpher Reservoir East Cell and return the East Cell to service.

b. On or before November 30, 2017, PWSA shall submit a complete permit application for an amended construction permit to replace the cover and liner on both cells of the Lanpher Reservoir.

c. Within 150 days of the date the Department issues an amended construction permit, PWSA shall replace the West Cell cover and liner, and apply for an operation permit for the West Cell. PWSA shall return the West Cell to service immediately upon issuance of an operation permit by the Department.

d. Within 150 days of returning the West Cell to service, PWSA shall replace the East Cell cover and liner, and apply for an operation permit for the East Cell. PWSA shall return the East Cell to service immediately upon issuance of an operation permit by the Department.

3. **Bruecken Pump Station**. PWSA shall complete the actions necessary to ensure reliability of the Bruecken Pump Station in accordance with the following schedule:

a. On or before November 30, 2017, PWSA shall submit a complete application for an amended construction permit to install a backup variable speed pump at the Bruecken Pump Station.

b. Within 60 days of the date the Department issues an amended construction permit, PWSA shall obtain the backup pump and submit to the Department a standard operating procedure (SOP) describing the circumstances and specific mechanism as to how it will be brought into service if needed.

c. On or before December 31, 2017, PWSA shall provide emergency backup power for the Bruecken Pump Station and shall submit to the Department the details of the backup power system and a copy of the SOP that will be added to PWSA's Emergency Response Plan for use of the backup power system.

4. **Pressure Sensors**. PWSA shall complete the actions necessary to assure that water at adequate pressure is continuously supplied to the users in accordance with the following schedule:

a. On or before November 30, 2017, PWSA shall identify critical low pressure points in each of the System's pressure zones and provide those locations to the

Department for its approval, in the form of a System drawing identifying both the pressure zones and the critical low pressure points.

b. Within 30 days of the Department's approval of PWSA's submission, PWSA shall install pressure sensors at each of these locations capable of reporting pressure data to PWSA in real time. PWSA will maintain adequate records of pressure sensor data with data points recorded no less frequently than once every 15 minutes. These readings shall be used by PWSA to make any necessary System changes or repairs as soon as possible to assure adequate pressures are maintained.

c. PWSA must notify the Department within one hour if any of the following occur:

i. If any pressure data indicates a loss of positive pressure.

ii. If any two consecutive 15-minute readings are below 20 PSI.

5. **Capital Improvement Projects**. On or before November 30, 2017, PWSA shall provide a detailed schedule for completion of the longer term projects set forth in PWSA's "Capital Improvement Projects from the 2017 to 2021 Capital Improvement Program" presented by PWSA to the Department on October 18, 2017, attached as Exhibit A. The schedule shall include dates for design, permitting, procurement, construction, start-up and final in-service date for each individual project.

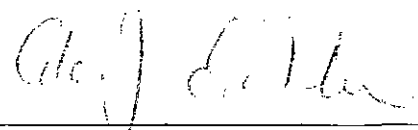
6. **Qualified Personnel**. PWSA and the City shall ensure that adequately and appropriately qualified staff and/or consultants are employed to perform the tasks required under this Administrative Order.

7. **Funding**. The City shall ensure that PWSA has funds available to complete all of the tasks required under this Administrative Order.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa. C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's Rules of Practice and Procedure may be obtained from the Board. The appeal form and the Board's Rules of Practice and Procedure are also available in Braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD. IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

FOR THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:



Alan J. Eichler
Program Manager
Safe Drinking Water Program

EXHIBIT A

2017-2021 Capital Projects Defined Projects*

Project Name	Project Budget	Start Date
Aspinwall WTP Electrical & Backup Power Improvements	$ 26,320,000	Mar-17
Aspinwall WTP Pretreatment & Clarification Improvements	$ 28,371,000	Mar-17
Clearwell Emergency Response Project	$ 27,630,000	Mar-17
Highland Reservoir Pump Station and Rising Main	$ 31,690,000	Mar-17
Maryland Avenue Green Infrastructure	$ 6,495,000	Mar-17
Ft. Duquesne Bridge Water Main Improvements	$ 770,000	Mar-17
31st Ward Sewer Improvements	$ 13,520,00	Mar-17
Highland MFP Critical Process Improvements	$ 985,000	Mar-17
Highland MFP Filtration Module Replacement	$ 2,950,000	Apr-17
Highland MFP Transformer and UPS Replacement	$ 90,000	Apr-17
Lawn and Ophelia Green Infrastructure	$ 845,000	Aug-17

Exh. RAW/C-11

* Note: Annual reoccurring projects NOT included (i.e. lead, valve, hydrant, catch basin, relays, CIPP, etc.)

2017-2021 Capital Projects
Defined Projects*

Project Name	Project Budget	Start Date
MFP FRP Chemical Tank Inspections & Repairs/Replacement	$ 165,000	Aug-17
Smallman Street Infrastructure Improvements	$ 12,700,000	Sept-17
Lanpher Reservoir Improvements	$ 16,830,000	Sept-17
Corrosion Control Chemical Storage & Feed Systems	$ 3,960,000	Oct-17
Aspinwall Pump Station Improvements	$ 29,460,000	Nov-17
2018 Small Water Main Replacement Project	$ 10,520,000	Nov-17
2018 Sewers Under Structures	$ 6,580,000	Nov-17
Maytide Storm and Sanitary Sewer System Improvements	$ 2,660,000	Nov-17
Woods Run Stream Inflow - Mairdale Avenue	$ 1,920,000	Nov-17
Wightman Park Green Infrastructure Project	$ 1,525,000	Nov-17
Aspinwall Pump Station to Lanpher Reservoir Rising Main	$ 48,684,000	Feb-18
Bruecken Pump Station Improvements	$25,080,000	Feb-18
Herron Hill Reservoir Improvements	$ 4,000,000	Feb-18

Exh. RAW/C-11

* Note: Annual reoccurring projects NOT included (i.e. lead, valve, hydrant, catch basin, relays, CIPP, etc.)

2017-2021 Capital Projects
Defined Projects*

Project Name	Project Budget	Start Date
Chlorine Booster Station Improvements	$ 6,175,000	Feb-18
Panther Hollow/Four Mile Run Green Infrastructure	$ 40,500,00	Feb-18
District Water and Pressure Meters	$ 2,795,000	Feb-18
Garfield Tank Improvements	$ 3,970,000	Feb-18
Lincoln Tank Improvements	$ 4,105,000	Feb-18
Washout Disconnection Program	$ 12,750,000	Mar-18
Heth's Run Green Infrastructure	$ 10,960,000	Mar-18

Exh. RAWC-11

* Note: Annual reoccurring projects NOT included (i.e. lead, valve, hydrant, catch basin, relays, CIPP, etc.)

	A	B	C	D	E	F	G	H	I	J	K
1	**Directed Question #**	**Project Name**	**Project Descriptions**	**Project Justification**	**Budgeted Cost**	**Funds**	**Design Engineer**	**Start Date**	**Design Complete**	**Construction Start**	**Date of Completion & In Service**
2	6.1	Washout Disconnection	Investigation and, if necessary, disconnection of large water main washouts from the sewer system.	A number of older washouts on larger mains were directly connected to sewers with a closed valve during construction. These washouts (cross connections) must be completely disconnected from the sewer.	$13,140,000	Borrowed	TBD - Via RFP	Oct-18	Jan-21	May-21	Sep-23
3		2019 Large Diameter Water Main Improvements	Strategic replacement or rehabilitation of large diameter water mains (16-inch and larger) and appurtenances to improve system reliability and hydraulics, including internal and external inspections. In 2019, Rising Mains 3 and 4 from the Bruecken Pump Station have been selected for improvements, which is approximatly 2.3 miles of main.	By maintaining a proactive approach to asset management, efforts can be directed towards remedying assets before their failure, thus resulting in a savings in the replacement cost as compared to emergency/reactive repair costs. Typically, large diameter pipe is not readily available and has a 6 to 8 week lead time for delivery. A large percentage of the Authority's large diameter mains are riveted steel, which cannot be easily repaired without the use of field fabricated specialty fittings. Rising Mains 3 and 4 from Bruecken Pump Station to Highland 2 Reservoir were chosen for the 2019 Large Diameter Water Main Improvements Program due to their criticality when the clearwell is being rebuilt.	$23,550,000	Borrowed	TBD - Via RFP. Initial scoping to be completed by Mott MacDonald.	Feb-19	Sep-21	Jan-22	Mar-22
4	6.8	Aspinwall Pump Station to Lanpher Reservoir Rising Main	Construction of a new, redundant rising main from Aspinwall Pump Station to Lanpher Reservoir.	The existing 60-inch rising main that supplies the Lanpher Reservoir is a 150 year old riveted steel pipe, has several tap connections to critical and bulk customers, and has experienced recent pipe failures. The proposed rising main would serve as a primary supply source for Lanpher Reservoir during the Clearwell Replacement Project and a redundant supply line in case of a failure or planned cleaning and rehabilitation of the existing 60-inch supply main.	$49,454,000	Borrowed	Michael Baker, Inc.	Sep-18	Sep-20	Jun-20	Sep-22
5		**Aspinwall Pump Station Improvements**	**Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems. The current pump station was constructed in 1914 and many of the components were installed in 1958.**	**The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff.**	**$29,690,000**	**Borrowed**	**CDM**	**May-19**	**TBD - Depends upon HSPS**	**TBD - Depends upon HSPS**	**Mar-23**
6	6.12	Bruecken Pump Station Improvements	Replacement of aged pump and valve equipment, electrical equipment, HVAC, and auxiliary systems and rehabilitation of the building architectural and energy management systems. The pump station was constructed in 1931.	The pump station is in need of renovations and upgrades to maintain service, restore a 20 to 25 year useful life expectancy, and to provide safer conditions for the staff. This project is a critical component of the clearwell replacement project.	$24,990,000	Borrowed	Mott MacDonald	Apr-19	TBD - Depends upon HSPS	TBD - Depends upon HSPS	Feb-23
7	6.5	Aspinwall Water Treatment Plant High Service Pump Station	In lieu of Aspinwall and Bruecken Pump Stations, a new high service pump station may be constructed to service Highland Reservoir 1, Highland Reservoir 2, Lanpher Reservoir, and Fox Chapel.	If this project moves forward, the Aspinwall Pump Station Improvements and Bruecken Pump Station Improvements Project would be reduced to only what is necessary to keep the stations operational until the new station is online. This project is a critical component of the clearwell replacement project.	$53,620,000	Borrowed	**ARCADIS providing intial feasibility study. Design Firm TBD.**	Oct-18	May-19	Oct-20	Feb-23
8	6.9	Lanpher Reservoir Improvements	Installation of new liner and cover and provide ancillary improvements to the entire facility, including Sodium Hypochlorite injection system, SCADA system improvements, site electrical improvements, sluice gate rehabilitation, dewatering pumps, concrete repairs and necessary site work.	Work required as a result of a failure of the reservoir floating cover in September 2017. Sodium hypochlorite feed system is reaching the end of its design life.	$29,643,000	Borrowed	ARCADIS	Sep-17	Dec-18	Apr-18	Jun-19
9	6.4	Highland Pump Station and Rising Main	Construction of a new finished water pump station and transmission main to supply water to the Highland No 1 Service Area from Highland No. 2 Reservoir	All compliant water supply for the Highland No. 1 Service Area currently flows through the Highland No. 1 Reservoir and the Membrane Filtration Plant (MFP) or directly into the system. There is no online storage for the system, and there is no other source water supply for the Highland No. 1 Service Area. In addition to providing alternate supply, this project will temporarily provide finished water that meets the chlorine disinfection rules to the Highland No. 1 Service Area during the Clearwell Replacement Project. Additionally, this new facility will also be designed to service the Garfield pressure district, thus eliminating the need to rehabilitate the (New) Highland Pump Station.	$37,130,000	Borrowed	Mott MacDonald	Mar-17	Feb-19	Jul-20	Jun-22
10	6.1	Aspinwall Treatment Plant Pretreatment Chemical System and Clarification Improvements	Improvements to pretreatment chemical systems, clarifiers, sedimenation, and associated systems to provide enhanced water treatment.	Chemical treatment systems are a critical component to producing safe drinking water. Components of the chemical treatment systems can no longer be operated in a safe, effective, or reliable manner to meet water quality requirements. Many bulk water treatment chemicals present safety hazards to staff. The storage and pumping systems associated with these chemicals have reached the end of their useful life. Failures resulting in dust creation and chemical spills can place operators in unsafe working conditions and can cause physical damage to equipment and structures, as well as environmental contamination.	$27,310,000	Borrowed	ARCADIS	Mar-17			Feb-23
11	6.2	Aspinwall Water Treatment Plant Electrical and Backup Power Improvements	Improvements to electrical systems at Aspinwall Water Treatment Plant, including provisions for backup power systems, upgrades to existing electrical distribution system, and replacement of motor control centers	Electrical systems at the Aspinwall Water Treatment Plant have generally met the end of their useful lives and spare/replacement parts are unavailable. Electrical panels do not meet current safety standards, including lack of arc flash protection. Additionally, the Aspinwall Water Treatment Plant does not have redundant power systems or a means for stand-by power for critical pumping and treatment systems.	$26,520,000	Borrowed	Wood - Preliminary Design	Mar-17	Jul-19	Dec-20	Feb-23

	A	B	C	D	E	F	G	H	I	J	K
1	Directed Question #	Project Name	Project Descriptions	Project Justification	Budgeted Cost	Funds	Design Engineer	Start Date	Design Complete	Construction Start	Date of Completion & In Service
12		Clearwell Emergency Response Project	Construction of piping, suction wells, if necessary, and appurtenances to bypass the existing clearwell.	This project will provide a means to bypass the existing clearwell. Note: Disinfection requirements will not be achieved while bypassing is occurring. Additionally, this infrastructure will be required to maintain water supply to PWSA's customers for the rehabilitation or replacement of the existing clearwell.	$27,670,000	Borrowed	GAI/Arcadis - Preliminary Design. Final Design Firm TBD	Mar-17	May-19	TBD - Depends upon HSPS	Apr-22
13	6.7	Clearwell Improvements	Replacement of the existing 108 year old, single cell clearwell (finished water structure) The clearwell was constructed in 1908 and has not undergone any major modifications or upgrades since. It has two main functions: providing equalization storage that allows the filters to operate independently of potential fluctuations in system demands and providing sufficient retention contact time for disinfection to meet the requirements of the Federal Surface Water Treatment Rule and Long-Term 2 Enhanced Surface Water Treatment Rule.	Considering the age and condition of the clearwell, it is the water system's weakest link as there are no practical means to deliver water by bypassing the clearwell, while maintaining the required volume, quality, and contact time.	$67,810,000	Borrowed	TBD	Apr-19	May-19	Jul-22	Mar-24
14	6.11	Highland Park Membrane Filtration Module Replacement Program	Replace membrane modules, which includes a total of 10 racks each with 80 modules. Note: Four racks were replaced in 2017.	Replacement necessary to maintain operation of the MFP.	$21,717,711	Borrowed	Hatch	May-17	May-17		Jan-20
15		Highland Park Membrane Filtration Plant UV System	Installation of a UV treatment system and appurtenances at the Highland Park Membrane Filtration Plant (MFP).	To comply with the 1 log inactivation of Giardia cysts and the PADEP Administrative Order dated October 25, 2017.	$5,855,000	Borrowed	Arcadis	Oct-17	Oct-17	Feb-19	Jul-19
16		MFP Assessment and Critical Process Improvements	Complete a condition assessment of systems supporting the treatment process and perform critical improvements to maintain water treatment and allow full warranty of replacement modules. Improvements may include electrical, chemical feed, strainers, and other support systems.		$1,755,500	Borrowed		Mar-17			Dec-18

Comprehensive Performance Evaluation Actions Checklist

Itemized List of Recommended Actions	Status	
Policies – Administration		
Establish and communicate to staff at all levels a clear policy to meet a full range of water quality optimization goals	Developed Water Quality Day- Hosting individual training sessions at the plant, new labor management meetings, Biweekly Senior Management Meetings, Hired 2 Senior Managers	Ongoing
Fill the vacancies in key management positions	Added Two Senior Managers, Reassigned Deputy Director of Ops, Added a Chief Of Water Quality	Complete
Change existing policy requiring residency within the Pittsburgh city limits	This policy has changed to hire key personnel mentioned above who live outside the City Limits	Partial
Change the policy that only lab staff can establish process control setpoints so that the role that properly certified operators is not diminished	A certified operators team meets regularly to discuss operational issues and required improvements. Chief of Water Quality, Environmental Compliance Manager, Senior Manager SCADA, Senior Manager Operations, Senior Manager Capital Projects. We are also having Water Quality Day to encourage interactions between operations and laboratory staff. Staff Leaders encouraged to meet management once per month	Complete
Adequately incentivize operator certification for existing staff and require for new hires	PWSA is now providing on site training for operators as well as fund the offsite training needed for CEUs and State Certifications.	Continuous
Supervision – Administration		
Hire a Director of Water Production	Seeking to develop existing staff to promote to this position	On Hold
Make simultaneous compliance a priority (currently the primary focus is TriHM precursor removal and DBP control, with limited focus directed towards turbidity optimization	PWSA's Certified Operator Team routinely evaluates status of all compliance requirements. PWSA is looking to optimize coagulation and has maintained a steady concentration of chlorine leaving the plant for the past year	Continuous
Involve operators with water quality process control decisions	PWSA is holding training events with both the operations and lab staff to promote collaboration with operators and Certified Operator Team	Continuous
Clearly define roles and responsibilities, so that the uncertainty regarding who has primary responsibility for completion of certain tasks, is eliminated	Certified Operator Team compiling SOP's with Roles and Responsibilities	Ongoing
Develop process control related special studies in the plant with more involvement from plant staff and less reliance on consultant recommendations	Collaborating with Univ. of Pittsburgh and CMU to implement existing pilot plant. Restoration of facilities has begun	Ongoing
Establish an in-house training program for operational staff	PWSA is providing in house training provided by its employees, its consultants, and the DEP	Continuous
Representative Sampling – Operations		
Establish a method to assess turbidity spikes and understand when individual filters are online vs. offline	The SCADA Manager and laboratory are working with operations to assess turbidity spikes. PWSA is also working with HACH and the Raw TU turbidimeters to develop a tule to identify real turbidity spikes on the filter effluents. PWSA is also pulling and reviewing data for the Partnership for Safe Drinking Water	Ongoing
Change the process of verifying massive amounts of critical water quality compliance data so that it does not fall on one individual	PWSA has a Chief of Water Quality, who works in conjunction with Environmental Compliance Operations, and the Laboratory to review water quality data. Some functions have been automated	Completed
Make sure the IFE online turbidimeter sample tap location does monitor both sides of each individual filter	The sample tap location was changed to effectively monitor both sides of the filter	Completed
Resolve the problem with the flow meter calibration and/or electrical "noise" and/or valves not fully closing so there is no flow during periods when those filters should be offline for backwash	Electrical noise source not yet identified. Continue evaluation	Ongoing
Make sure grab sample taps for individual filters are representative of water quality from each filter cell and filter to waste turbidity	Operators and Lab Staff Trained and performing as required. Sample taps were moved to ensure water samples represent all filters. Separate turbidity meters were installed to monitor filter to waste turbidity	Continuous
Make sure IFE and CFE turbidimeters are not capped at 1 NTU	SCADA was changed to remove the previous cap	Completed
Consistently utilize filter to waste step	Operations staff trained to follow SOP	Continuous
Make sure flow rates for turbidimeters are within the manufacturer recommended range	Rates are checked quarterly	Continuous
Make sure constant head levels for the CL-17 chlorine analyzer are within the manufacturer recommended range	Rates are checked quarterly	Continuous
Remove the capped maximum of 50 NTU and 5 NTU for clarifier and sedimentation basin turbidity data respectively	The range was changed in SCADA	Completed
Monitor individual clarifiers and individual sedimentation basin effluent turbidities	The laboratory is performing studies to see the differences between each clarifier. They are working with AECOM to complete this work	Continuous
The continuous online raw water turbidimeter needs to draw samples before the point of potassium permanganate injection	We are looking at installing another Raw water turbidity meter in the lab to sample water from the lab pump. This water is free from permanganate. This issue is that this pump sometimes freezes in the winter	Incomplete
Application of Concepts and Testing to Process Control – Operations		
Adjust ferric chloride dosage rates with the mindset that the Allegheny is not a stable source	PWSA does regular jar testing to adjust dosage rates and is now looking into a ferric blend chemical that provides more consistent water turbidity	Ongoing
Optimize coagulant and polymer doses by using process control tools, such as jar testing, streaming current monitor or zeta potential	PWSA purchased a Zeta meter to facilitate process control. Evaluating a ferric blend chemical to optimize Coagulation and turbidity control	Ongoing
Create an accurate method of determining maximum chlorine residual and minimum clear well volume data for use in the CT calculation	PWSA will have DEP training regarding CT on March 7, 2019. PWSA is also developing internal charts based on temp and pH	Planned
Create an accurate method to verify actual verses theoretical ferric chloride dosages	In coordination with the Ferric Blend evaluation, PWSA developing a method to verify performance	Ongoing
Allow operators to have access to accurate plant flow rate data to calculate ferric chloride dosages via SCADA	PWSA is restoring existing and installing new flow monitors to make this possible	Ongoing
Perform clarifier sludge depth or sludge density testing	Clarifiers have been drained, cleaned, and are being repaired. Future operations will minimize sludge accumulations	Ongoing
Investigate all clarified and settled water spikes	The new water quality team is investigating all abnormalities	Continuous
Conduct routine secondary verifications of the individual filter turbidimeters	PWSA changed process and was able to verify that online and bench meters matched	Complete
Utilize data from turbidimeter comparisons to assess accuracy of the on line meters	PWSA conducted a study to verify the accuracy of the on line meters	Completed
Establish an SOP to test new filter media to establish baseline emotion and/or monitor change in condition with age	PWSA utilized a contractor to extract samples of the filter media and send them for analysis. This will now occur annually	Completed
Routinely conduct long term analysis of water quality data trends to be used for data based decision making	PWSA is working with EPA, DEP, and consultants to develop data management and comparative SOP	Ongoing
Involve plant staff in the design of or conducting special studies (e.g., optimizing permanganate feed locations, individual clarifier basin performance study, filter backwash evaluation, in plant DBP formation)	PWSA is establishing labor management meetings to inform and involve plant staff with major changes	Continuous
Thoroughly consider unintended process control impacts before accepting preliminary process control modification recommendations from consultants (e.g. considering stopping raw water potassium permanganate feed and relying on Mn removal via filtration process)	PWSA's Chief of Water Quality assists PWSA Operations Management and Compliance review studies presented by consultants	Continuous
Study the impacts of filter backwash recycle on pretreatment processes and finished water quality	Existing pretreatment system impacts are being reviewed. Improved backwash operations being implemented	Ongoing
Determine if east and west raw water intake structures allow flexibility to draw water from different depths within the river to target the best available source water quality	Contractor ARCADIS contracted to perform field evaluation including dive study	Under Study

Maintenance (Preventative/ Corrective) – Maintenance		
Perform clear well maintenance and cleaning	Existing clearwell cannot be shut down. Cleaning using ROV may lead to excess turbidity in effluent. Evaluating options.	Under Study
Routinely remove sludge from flocculators and clarifiers	PWSA has cleaned all clarifiers and is taking them down individually to make repairs. Completion by June 2019	Ongoing
Reduce the accumulation of sludge in the sedimentation basins to increase basin volume decrease the amount of intermittent settled turbidity spikes	PWSA has cleaned all clarifiers and is taking them down individually to make repairs. Completion by June 2019	Completed
Account for frequent maintenance and/or the ability to bring chemicals close to the injection point line clogging (e.g. hypochlorite, soda ash)	PWSA and Consultants are reviewing all chemical addition points and chemical feed systems. Contract for upgrades under preparation	Ongoing
Calibrate plant flow meters so that data can be accurately transmitted to the SCADA system	PWSA has engaged Consultants to Perform field calibration	Ongoing
Identify sedimentation basin effluent weir, location, condition and maintenance history	PWSA has engaged Consultants to Perform field inspections	Ongoing
Make raw water intake valves adjustable	A dive team has evaluated the current condition. Consultant developing Design Documents for Bidding	Ongoing
Create a comprehensive work order system so that equipment in need of repair can be accurately tracked	PWSA is developing a Company Wide Automated Tablet based Work Order System. Ultimately, this system will be integrated into a CMMS system to be completed by the end of 2020	Ongoing
Planning – Administration		
Implement long range planning to build and maintain sustainable water system infrastructure	Long range planning complete	Complete
Implement a plan to generate income sufficient to sustain a WTP capable of achieving optimal performance goals	2019 Budgets include Operations and Capital budgets sufficient to implement the long term plan and CPE recommendations	Complete
Complacency – Administration		
Adjust coagulant dosage and optimize clarifiers for particle removal	PWSA is conducting jar testing and is looking at a ferric blend to enhance coagulation	Ongoing
Adequately reinvest in aging infrastructure	Capital budgets include allowances for projects based upon their individual priorities	Continuous
Do not let infrastructure breakdowns go unaddressed for extended periods of time	Capital budgets include allowances for projects based upon their individual priorities	Continuous
Reliability – Administration		
Create a process so that the clear well can be taken out of service for maintenance	Planning complete for staged major project implementation. Future clearwell design and operations to allow multiple cell design and operations	Ongoing
Make sure the emergency power for the treatment plant includes the raw water pumps	Planning complete for electrical system upgrades, including standby power systems. Design and construction to be implemented as soon as funding permits	Ongoing
Make sure all unit processes that are not operating are on schedule to be placed back into service (three flocculators are out of service, one clarification basin is not operational, raw water flow readings are inaccurate, IFE turbidity data is not reliably reflecting individual filter performance)	Operations Management Team actively planning restoration of all facilities currently out of service, prioritized based upon the degree of reserve capacity available for each process. (See above Clarifier discussion)	Ongoing
Ensure the overall depth of staff capability is sufficient to consistently and reliably meet optimization goals	Staffing plans have been funded to achieve proper staff goals. Some difficulty hiring experienced staff due to domicile requirement	Continuous
Disinfection Barrier – Design		
Begin significant rehabilitation or replacement of the clear well to maintain the integrity of the disinfection process		Ongoing
Compensation – Administration		
Offer higher salaries to ensure the best available staff are hired	Salaries have been aligned with regional water utilities	Completed
Create incentives for operators to pursue certifications	Providing training free of charge, and overtime compensation for those who pass the Certification tests	Ongoing

Reserves – Administration		
Lessen the amount of water accountability inaccuracies so that revenue increases	Seeking accurate non-revenue water evaluation and customer metering to accurately reflect consumer uses.	Yes/ No
Adequately develop reserves for capital replacement	Financial Plan has developed reserves to address unknown capital needs	
Correct policies that 1) provide free water for certain City needs, 2) contribute funding to City projects outside of PWSA, 3) requires PWSA to compensate ALCOSAN regardless of whether the customer pays water or sewer charges to PWSA, 4) requires payment of $130M (water) and $100M (sewer) to the city of Pittsburgh through the PWSA lease agreement, 5) subsidize Pittsburgh customers receiving water from Pennsylvania American Water Company (PAWC) reportedly costs PWSA $5M annually	Issues being assessed through the PIR Compliance Plans and Tariff proposals All issues will be addressed by 2024	Ongoing
Reduce the $750M debt so that $0 80 of each revenue $1 00 is not directed toward paying debt	Total Debt has been analyzed in light of the capital plans for improvements as required. Financial metrics have been met for additional revenue bond funding to implement the Capital Improvement plans	Continuous
Chemical Storage and Facilities – Design		
Create more storage space for ferric chloride	Assessment of alternative chemical treatments is underway by Consultants. Final Chemical facilities designs will address operational and storage requirements for each chemical	Ongoing
Rehab the condition of sodium hypochlorite piping facilities so that it is not necessary to truck the chemical to the filter effluent injection point	Assessment of alternative chemical treatments is underway by PWSA and its Consultants. Final Chemical facilities designs will address operational and storage requirements for each chemical.	Ongoing
Clarification/ Sedimentation – Design		
Increase the capacity of the clarifier	A pilot study is occurring to examine the use of plate settlers	Ongoing
Cover the sedimentation Basins	Current facility plans include assessment of the purpose and value of the Sedimentation Basins in light of their current condition, and alternative treatment approaches	Ongoing
Process Controllability and Instrumentation/ Automation – Design		
Chemical feed rates should move from manual to automatic adjustment to account for changes in plant flow rates	PWSA is installing flow monitors and chemical measurement devices to implement automated chemical feed systems as part of the Chemical Feed System Overhaul	Ongoing
Create a process that differentiates critical alarms from other alarms in the SCADA system	SCADA system upgrades will include critical alarm differentiation	Ongoing
Operation Guidelines/ Procedures – Operations		
Make sure SOPs are easily accessible and posted in critical locations	Creating simplified sheets to be posted in key locations	Ongoing
Establish SOPs to adjust pretreatment to accommodate for seasonal temperature changes	PWSA conducting jar testing to develop charts to help adjust for seasonal changes	Ongoing
		Yes, ongoing
Work Environment – Administration		
Correct electrical and other safety issues at the plant	Overall Consultant prepared electrical plan completed Local electrical panels evaluations at each process system underway. Design and implementation of upgrades incorporated into Capital Improvement Plans	Ongoing
Install hand rails on the filter decks	Work not yet authorized	Incomplete
Intake Structure – Design		
Make the river intake structures flexible enough to draw water varying levels	Consultant ARCADIS engaged to develop and design new intake system to be completed by 2024	Ongoing
Increase the distance between the east and west intakes to provide more resiliency	Consultant - ARCADIS engaged to develop and design new intake system to be completed by 2024	Ongoing
Ensure functional capability to feed potassium permanganate at the west intake	Assessment of alternative chemical treatments is underway by Consultants. Final Chemical facilities designs will address operational and storage requirements for each chemical	Ongoing

Project Name	Project Number	Project Phase	Project Type	Project Start (Year)	Capital Project Budget	Actual 2018 Expenditures	Projected 2019 Expenditures	Projected 2020 Expenditures	Projected 2021 Expenditures	Projected 2022 Expenditures	Projected 2023 Expenditures
2018 Utility Cost Shares		Construction	Other	2018	$ 3,000,000.00	$ -	$ 377,699.03	$ -	$ -	$ -	$ -
GIS Upgrades and Water and Sewer Master Plans		Scoping	Other	2019	$ 3,000,000.00	$ -	$ 1,500,000.00	$ 1,500,000.00	$ -	$ -	$ -
Long-Term Infrastructure Improvement Plan (LTIIP)	2018-325-102-0	Other	Other	2018	$ 1,100,000.00	$ 491,398.78	$ 257,167.68	$ 51,433.54	$ -	$ -	$ -
Program Management Services	2018-325-103-0	Other	Other	2018	$ 1,000,000.00	$ 643,312.13	$ 356,687.87	$ -	$ -	$ -	$ -
CMMS		Scoping	Other	2019	$ 10,000,000.00	$ -	$ 500,000.00	$ 3,000,000.00	$ 3,000,000.00	$ 2,523,809.52	$ 142,857.14
2019 Utility Cost Shares		Inactive	Other	2019	$ 3,000,000.00	$ -	$ 2,250,000.00	$ 750,000.00	$ -	$ -	$ -
2019 Vehicle and Major Equipment Purchases		Inactive	Other	2019	$ 3,399,000.00	$ -	$ 3,399,000.00	$ -	$ -	$ -	$ -
2020 Utility Cost Shares		Inactive	Other	2020	$ 3,000,000.00	$ -	$ -	$ 2,250,000.00	$ 750,000.00	$ -	$ -
2020 Vehicle and Major Equipment Purchases		Inactive	Other	2020	$ 2,651,000.00	$ -	$ -	$ 2,651,000.00	$ -	$ -	$ -
2021 Utility Cost Shares		Inactive	Other	2021	$ 3,000,000.00	$ -	$ -	$ -	$ 2,250,000.00	$ 750,000.00	$ -
2021 Vehicle and Major Equipment Purchases		Inactive	Other	2021	$ 2,367,200.00	$ -	$ -	$ -	$ 2,367,200.00	$ -	$ -
2022 Utility Cost Shares		Inactive	Other	2022	$ 3,000,000.00	$ -	$ -	$ -	$ -	$ 2,250,000.00	$ 750,000.00
2022 Vehicle and Major Equipment Purchases		Inactive	Other	2022	$ 555,500.00	$ -	$ -	$ -	$ -	$ 555,500.00	$ -
2023 Utility Cost Shares		Inactive	Other	2023	$ 3,000,000.00	$ -	$ -	$ -	$ -	$ -	$ 2,250,000.00
2023 Vehicle and Major Equipment Purchases		Inactive	Other	2023	$ 374,000.00	$ -	$ -	$ -	$ -	$ -	$ 374,000.00
2018 Catch Basin Replacement	2018-424-101-0	Construction	Storm	2018	$ 10,392,500.00	$ 2,541,458.92	$ 3,713,005.78	$ 243,415.07	$ -	$ -	$ -
Volunteer's Field Green Infrastructure	2018-GI-104-0	Preliminary Design	Storm	2018	$ 1,465,000.00	$ 4,722.31	$ 511,120.18	$ 922,126.63	$ -	$ -	$ -
SMR Streambank Stabilization	2018-GI-107-0	Preliminary Design	Storm	2018	$ 1,385,000.00	$ 3,107.38	$ 508,532.17	$ 873,358.19	$ -	$ -	$ -
Overbrook Middle School Pollution and Flood Reduction		Scoping	Storm	2019	$ 6,500,000.00	$ -	$ 488,863.64	$ 4,200,646.85	$ 1,810,489.51	$ -	$ -
St. Johns Stormwater Management Project	2019-424-101-0	Scoping	Storm	2019	$ 75,000.00	$ -		$ -	$ -	$ -	$ -
MS4 Compliance Projects		Inactive	Storm	2018	$ 1,955,000.00	$ -	$ 53,444.44	$ 283,777.78	$ 1,617,777.78	$ -	$ -
Tide Gate Installations		Inactive	Storm	2018	$ 4,500,000.00	$ -	$ 295,263.16	$ 308,684.21	$ 3,210,674.60	$ 685,378.04	$ -
2019 Stormsystem Improvements		Inactive	Storm	2018	$ 3,580,000.00	$ -	$ 370,000.00	$ 2,847,857.14	$ 322,142.86	$ -	$ -
2019 Catch Basin and Inlet Replacement		Inactive	Storm	2019	$ 11,320,000.00	$ -	$ 924,132.33	$ 9,299,706.96	$ 1,096,160.71	$ -	$ -
2020 Stormsystem Improvements		Inactive	Storm	2019	$ 3,960,000.00	$ -	$ 21,428.57	$ 428,571.43	$ 3,153,214.29	$ 356,785.71	$ -
Saw Mill Run MS4 Compliance Projects		Inactive	Storm	2021	$ 8,500,000.00	$ -	$ -	$ -	$ 1,000,000.00	$ 3,000,000.00	$ 4,500,000.00
2020 Catch Basin and Inlet Replacement		Inactive	Storm	2020	$ 11,660,000.00	$ -	$ -	$ 84,908.42	$ 10,402,472.53	$ 1,172,619.05	$ -
2021 Stormsystem Improvements		Inactive	Storm	2020	$ 4,045,000.00	$ -	$ -	$ 22,147.86	$ 442,857.14	$ 3,225,714.29	$ 354,285.71
Mellon Terrace Sewer System Improvements		Inactive	Storm	2021	$ 2,030,000.00	$ -	$ -	$ -	$ 340,000.00	$ 1,690,000.00	$ -
2021 Catch Basin and Inlet Replacement		Inactive	Storm	2021	$ 12,030,000.00	$ -	$ -	$ -	$ 88,058.61	$ 10,732,417.58	$ 1,209,523.81
2022 Stormsystem Improvements		Inactive	Storm	2021	$ 4,230,000.00	$ -	$ -	$ -	$ 22,857.14	$ 457,142.86	$ 3,370,714.29
2022 Catch Basin and Inlet Replacement		Inactive	Storm	2022	$ 12,380,000.00	$ -	$ -	$ -	$ -	$ 91,208.79	$ 11,044,862.64
2023 Stormsystem Improvements		Inactive	Storm	2022	$ 4,375,000.00	$ -	$ -	$ -	$ -	$ 23,571.43	$ 471,428.57
2023 Catch Basin and Inlet Replacement		Inactive	Storm	2023	$ 12,720,000.00	$ -	$ -	$ -	$ -	$ -	$ 91,208.79
2024 Stormsystem Improvements		Inactive	Storm	2023	$ 4,490,000.00	$ -	$ -	$ -	$ -	$ -	$ 24,285.71
Lawn and Ophelia	2017-424-104-0	Design	Storm-Green	2017	$ 785,000.00	$ 108,449.67	$ 315,623.32	$ 345,225.00	$ -	$ -	$ -
Wightman Park	2017-424-105-0	Design	Storm-Green	2017	$ 2,365,000.00	$ 304,772.46	$ 68,692.59	$ 1,736,740.00	$ 204,000.00	$ -	$ -
Maryland Avenue Green Infrastructure	2017-424-101-0	Design	Storm-Green	2017	$ 9,384,000.00	$ 755,098.68	$ 645,931.56	$ 4,140,831.52	$ 2,797,087.47	$ 1,064,197.67	$ -
Woods Run Stream Inflow - Mairdale Avenue	2017-424-108-0	Design	Storm-Green	2017	$ 4,296,000.00	$ 369,002.20	$ 352,777.98	$ 3,065,246.50	$ 330,500.00	$ -	$ -
Four Mile Green Stormwater Infrastructure	2018-GI-102-0	Preliminary Design	Storm-Green	2018	$ 41,100,000.00	$ 1,471,917.94	$ 1,214,764.32	$ 6,616,476.82	$ 11,061,786.13	$ 11,061,786.13	$ 7,899,042.30
Woodland Drive Green/Stormwater Infrastructure	2018-GI-108-0	Preliminary Design	Storm-Green	2018	$ 1,195,000.00	$ -	$ 429,035.00	$ 735,250.00	$ -	$ -	$ -
Thomas and McPherson Green/Stormwater Infrastructure	2018-GI-106-0	Preliminary Design	Storm-Green	2018	$ 4,650,000.00	$ 6,789.84	$ 255,133.82	$ 1,976,879.04	$ 1,876,752.90	$ -	$ -
Southside Green/Stormwater	2019-GI-100-0	Preliminary Design	Storm-Green	2019	$ 8,694,000.00	$ -	$ 507,000.00	$ 2,099,833.33	$ 5,233,833.33	$ 663,333.33	$ -
EPA 308/City of Pittsburgh Source Reduction Response	2017-424-106-0	Other	Storm-Green	2017	$ 750,000.00	$ 172,696.11	$ 34,537.19	$ 6,907.44	$ -	$ -	$ -
Shamrock Way Green/Stormwater Infrastructure	2018-GI-105-0	Inactive	Storm-Green	2018	$ 40,000.00	$ -	$ 40,000.00	$ -	$ -	$ -	$ -
Spring Garden Stream Removal		Scoping	Storm-Green	2019	$ 10,710,000.00	$ -	$ 350,833.33	$ 1,294,500.00	$ 8,260,333.33	$ 804,333.33	$ -
Heth's Run Green/Stormwater Infrastructure		Inactive	Storm Green	2018	$ 600,000.00	$ -	$ 235,000.00	$ 365,000.00	$ -	$ -	$ -
MLK Field Green/Stormwater Infrastructure		Inactive	Storm Green	2018	$ 3,402,000.00	$ -	$ -	$ 116,900.00	$ 455,100.00	$ 2,830,000.00	$ -
Homewood Park Green/Stormwater Infrastructure		Inactive	Storm-Green	2018	$ 2,720,000.00	$ -	$ 100,800.00	$ 431,771.43	$ 2,187,428.57	$ -	$ -
Negley Run/Washington Boulevard Green/Stormwater Infrastr		Inactive	Storm-Green	2018	$ 15,390,000.00	$ -	$ -	$ 540,000.00	$ 2,979,166.67	$ -	$ 8,100,000.00
Bus Rapid Transit (BRT)Green/Stormwater Infrastructure		Scoping	Storm-Green	2019	$ 6,050,000.00	$ -	$ 162,647.06	$ 800,588.24	$ 3,451,645.93	$ 1,635,118.78	$ -
M-29 Green/Stormwater Infrastructure		Inactive	Storm-Green	2019	$ 1,700,000.00	$ -	$ 566,666.67	$ 1,133,333.33	$ -	$ -	$ -
A-42 Green/Stormwater Infrastructure		Inactive	Storm-Green	2019	$ 1,700,000.00	$ -	$ 242,857.14	$ 485,714.29	$ 485,714.29	$ 485,714.29	$ -
Green/Stormwater Planning & Future Projects		Inactive	Storm-Green	2020	$ 12,500,000.00	$ -	$ -	$ 500,000.00	$ 1,500,000.00	$ 3,500,000.00	$ 7,000,000.00
Woods Run Stream Removal Phase 2		Inactive	Storm-Green	2021	$ 2,405,000.00	$ -	$ -	$ -	$ 491,923.08	$ 1,728,923.08	$ 184,153.85
Woods Run Stream Removal Phase 3		Inactive	Storm-Green	2022	$ 3,775,000.00	$ -	$ -	$ -	$ -	$ 378,333.33	$ 2,139,147.86
Smallman Street Reconstruction	2017-424-113-0	Construction	Various	2017	$ 16,867,000.00	$ 6,993,569.19	$ 2,487,514.78	$ -	$ -	$ -	$ -
2018 Sewer Reconstruction	2017-424-111-0	Construction	Wastewater	2017	$ 1,470,000.00	$ 469,045.70	$ 359,264.82	$ -	$ -	$ -	$ -
2018 Small Diameter Sewer Rehabilitation [IDIQ]	2018-424-100-0	Construction	Wastewater	2017	$ 1,910,000.00	$ 16,938.86	$ 929,991.55	$ 106,500.51	$ -	$ -	$ -
Ivyglen and Odette Sewer Reconstruction and Separation Proje	2018-424-102-0	Construction	Wastewater	2018	$ 1,900,000.00	$ 232,480.77	$ 1,292,736.93	$ 123,684.26	$ -	$ -	$ -
Larimer Avenue Sewer and 28th Street Slope Stabilization	2016-424-102-0	Design	Wastewater	2015	$ 695,901.09	$ 11,731.49	$ 67,000.00	$ 570,000.00	$ -	$ -	$ -
Mayflide Storm and Sanitary Sewer System Improvements	2017-424-109-0	Design	Wastewater	2017	$ 6,520,000.00	$ 233,884.84	$ 1,610,595.44	$ 3,952,259.16	$ -	$ -	$ -

Project Name	Project Number	Project Phase	Project Type	Project Start (Year)	Capital Project Budget	Actual 2018 Expenditures	Projected 2019 Expenditures	Projected 2020 Expenditures	Projected 2021 Expenditures	Projected 2022 Expenditures	Projected 2023 Expenditures
31st Ward Sewer System	2017-424-100-0	Design	Wastewater	2017	$ 13,730,000.00	$ 298,727.59	$ 730,608.84	$ 11,915,827.28	$ -	$ -	$ -
2019 Small Diameter Sewer Rehabilitation (Defined Sites)		Design	Wastewater	2019	$ 9,260,000.00	$ -	$ 818,743.23	$ 5,904,095.33	$ 2,433,563.52	$ -	$ -
2016 Forbes/Darlington	2016-424-107-0	Design	Wastewater	2015	$ -	$ 46,681.68	$ 80,815.44	$ -	$ -	$ -	$ -
2018 Sewers Under Structures	2017-424-110-0	Preliminary Design	Wastewater	2017	$ 6,680,000.00	$ 111,741.31	$ 563,413.61	$ 3,821,179.27	$ 2,063,820.73	$ -	$ -
2019 Wastewater System Improvements		Scoping	Wastewater	2019	$ 5,350,000.00	$ -	$ 344,516.13	$ 1,392,786.48	$ 3,178,976.96	$ 433,720.43	$ -
2019 Sewers Under Structures		Scoping	Wastewater	2019	$ 7,120,000.00	$ -	$ 294,193.55	$ 2,191,874.04	$ 4,054,254.99	$ 579,677.42	$ -
2019 Sewer Reconstruction		Scoping	Wastewater	2018	$ 1,620,000.00	$ -	$ 595,109.89	$ 1,042,747.25	$ -	$ -	$ -
2020 Large Diameter Sewer Rehabilitation		Scoping	Wastewater	2019	$ 3,800,000.00	$ -	$ 328,000.00	$ 3,153,000.00	$ 319,000.00	$ -	$ -
2020 Small Diameter Sewer Rehabilitation		Inactive	Wastewater	2019	$ 9,500,000.00	$ -	$ 620,961.54	$ 6,041,858.97	$ 2,837,179.49	$ -	$ -
2020 Sewer Reconstruction		Inactive	Wastewater	2019	$ 1,750,000.00	$ -	$ -	$ 623,145.60	$ 1,126,854.40	$ -	$ -
2021 Large Diameter Sewer Rehabilitation		Inactive	Wastewater	2020	$ 4,200,000.00	$ -	$ -	$ 366,000.00	$ 3,834,000.00	$ -	$ -
2020 Sewers Under Structures		Inactive	Wastewater	2019	$ 7,400,000.00	$ -	$ 44,571.43	$ 854,857.14	$ 3,359,873.02	$ 3,140,698.41	$ -
2021 Small Diameter Sewer Rehabilitation		Inactive	Wastewater	2020	$ 14,690,000.00	$ -	$ -	$ 959,230.77	$ 9,345,512.82	$ 4,385,256.41	$ -
2021 Sewer Reconstruction		Inactive	Wastewater	2020	$ 1,720,000.00	$ -	$ -	$ 19,345.24	$ 1,096,662.09	$ 603,992.67	$ -
2022 Large Diameter Sewer Rehabilitation		Inactive	Wastewater	2020	$ 4,310,000.00	$ -	$ -	$ -	$ 376,000.00	$ 3,934,000.00	$ -
2021 Sewers Under Structures		Inactive	Wastewater	2020	$ 7,415,000.00	$ -	$ -	$ 45,285.71	$ 869,142.86	$ 3,366,857.14	$ 3,133,714.29
2022 Small Diameter Sewer Rehabilitation		Inactive	Wastewater	2021	$ 17,090,000.00	$ -	$ -	$ -	$ 1,428,461.54	$ 9,417,179.49	$ 6,244,358.97
2022 Sewer Reconstruction		Inactive	Wastewater	2021	$ 1,750,000.00	$ -	$ -	$ -	$ 19,345.24	$ 1,111,662.09	$ 618,992.67
2023 Large Diameter Sewer Rehabilitation		Inactive	Wastewater	2021	$ 4,440,000.00	$ -	$ -	$ -	$ -	$ 386,000.00	$ 4,054,000.00
2022 Sewers Under Structures		Inactive	Wastewater	2021	$ 7,795,000.00	$ -	$ -	$ -	$ 47,000.00	$ 901,142.86	$ 3,537,904.76
2023 Small Diameter Sewer Rehabilitation		Inactive	Wastewater	2022	$ 17,600,000.00	$ -	$ -	$ -	$ -	$ 1,470,769.23	$ 9,698,717.95
2023 Sewer Reconstruction		Inactive	Wastewater	2022	$ 1,680,000.00	$ -	$ -	$ -	$ -	$ 20,833.33	$ 1,194,935.90
2024 Large Diameter Sewer Rehabilitation		Inactive	Wastewater	2022	$ 4,570,000.00	$ -	$ -	$ -	$ -	$ -	$ 396,000.00
2023 Sewers Under Structures		Inactive	Wastewater	2022	$ 8,055,000.00	$ -	$ -	$ -	$ -	$ 48,428.57	$ 929,714.29
2024 Small Diameter Sewer Rehabilitation		Inactive	Wastewater	2023	$ 17,820,000.00	$ -	$ -	$ -	$ -	$ -	$ 1,513,076.92
2024 Sewer Reconstruction		Inactive	Wastewater	2023	$ 1,680,000.00	$ -	$ -	$ -	$ -	$ -	$ 20,833.33
2025 Large Diameter Sewer Rehabilitation		Inactive	Wastewater	2023	$ 4,700,000.00	$ -	$ -	$ -	$ -	$ -	$ -
2024 Sewers Under Structures		Inactive	Wastewater	2023	$ 8,325,000.00	$ -	$ -	$ -	$ -	$ -	$ 50,142.86
M-29 Outfall Improvements	2018-424-103-0	Design	Wastewater	2019	$ 1,845,000.00	$ 9,618.52	$ 890,058.49	$ 979,272.73	$ -	$ -	$ -
2017 Valve Replacement	2017-325-104-0	Construction	Water-Distribution System	2017	$ 2,358,380.00	$ 1,389,517.19	$ 205,559.35	$ -	$ -	$ -	$ -
2017 Hydrant Replacement	2017-325-102-0	Construction	Water-Distribution System	2017	$ 1,170,438.00	$ 318,183.27	$ 211,254.73	$ -	$ -	$ -	$ -
2018 Water Relay	2018-325-101-0	Construction	Water-Distribution System	2018	$ 1,620,000.00	$ 9,297.10	$ 722,095.29	$ 480,090.11	$ -	$ -	$ -
2018 Small Meter Replacement		Construction	Water-Distribution System	2018	$ 2,249,060.00	$ -	$ 1,038,684.38	$ -	$ -	$ -	$ -
2019 Valve Replacement		Procurement	Water-Distribution System	2019	$ 6,565,000.00	$ -	$ 2,363,269.23	$ 3,926,730.77	$ -	$ -	$ -
2019 Hydrant Replacement		Procurement	Water-Distribution System	2019	$ 1,335,000.00	$ -	$ 478,429.49	$ 801,570.51	$ -	$ -	$ -
Ft. Duquesne Bridge Water Air Release Valve Repair	2017-325-100-0	Design	Water-Distribution System	2017	$ 2,850,000.00	$ 174,600.56	$ 883,647.44	$ 1,681,451.32	$ -	$ -	$ -
2018 Small Diameter Water Main Replacement	2017-325-103-0	Design	Water-Distribution System	2017	$ 10,680,000.00	$ 788,214.50	$ 3,080,557.03	$ 6,488,556.97	$ 26,250.00	$ -	$ -
Low Pressure Area Remediation		Scoping	Water-Distribution System	2019	$ 2,800,000.00	$ -	$ 406,642.16	$ 1,029,258.87	$ 1,193,445.38	$ 170,653.59	$ -
2019 Small Diameter Water Main Replacement		Scoping	Water-Distribution System	2019	$ 10,880,000.00	$ -	$ 813,333.33	$ 3,966,030.98	$ 5,890,635.68	$ -	$ -
Washout Disconnection		Scoping	Water-Distribution System	2019	$ 13,140,000.00	$ -	$ 764,166.67	$ 2,018,078.95	$ 3,485,157.89	$ 3,485,157.89	$ 3,387,438.60
2020 Small Diameter Water Main Replacement		Scoping	Water-Distribution System	2019	$ 54,340,000.00	$ -	$ 4,133,333.33	$ 20,196,896.37	$ 30,009,770.30	$ -	$ -
District Water and Pressure Meters		Design	Water-Distribution System	2019	$ 2,705,000.00	$ -	$ 116,666.67	$ 1,616,142.86	$ 972,190.48	$ -	$ -
2019 Unmetered and Flat Rate Properties		Scoping	Water-Distribution System	2019	$ 4,840,000.00	$ -	$ 345,000.00	$ 2,792,476.19	$ 1,702,523.81	$ -	$ -
2019 Small Meter Replacement		Inactive	Water-Distribution System	2019	$ 2,100,000.00	$ -	$ 1,400,000.00	$ 700,000.00	$ -	$ -	$ -
2020 Small Meter Replacement		Inactive	Water-Distribution System	2020	$ 2,200,000.00	$ -	$ -	$ 1,466,666.67	$ 733,333.33	$ -	$ -
2021 Small Meter Replacement		Inactive	Water-Distribution System	2021	$ 2,200,000.00	$ -	$ -	$ -	$ 1,466,666.67	$ 733,333.33	$ -
2022 Small Meter Replacement		Inactive	Water-Distribution System	2022	$ 2,300,000.00	$ -	$ -	$ -	$ -	$ 1,533,333.33	$ 766,666.67
2023 Small Meter Replacement		Inactive	Water-Distribution System	2023	$ 2,400,000.00	$ -	$ -	$ -	$ -	$ -	$ 1,600,000.00
2019 Large Meter Replacement		Inactive	Water-Distribution System	2019	$ 2,100,000.00	$ -	$ 1,925,000.00	$ 175,000.00	$ -	$ -	$ -
2020 Large Meter Replacement		Inactive	Water-Distribution System	2020	$ 2,200,000.00	$ -	$ -	$ 2,016,666.67	$ 183,333.33	$ -	$ -
2021 Large Meter Replacement		Inactive	Water-Distribution System	2021	$ 2,200,000.00	$ -	$ -	$ -	$ 2,016,666.67	$ 183,333.33	$ -
2022 Large Meter Replacement		Inactive	Water-Distribution System	2022	$ 2,300,000.00	$ -	$ -	$ -	$ -	$ 2,108,333.33	$ 191,666.67
2023 Large Meter Replacement		Inactive	Water-Distribution System	2023	$ 2,400,000.00	$ -	$ -	$ -	$ -	$ -	$ 2,200,000.00
2019 Water Relay		Inactive	Water-Distribution System	2019	$ 1,750,000.00	$ -	$ 93,307.69	$ 1,496,192.31	$ 160,500.00	$ -	$ -
2020 Unmetered and Flat Rate Properties		Inactive	Water-Distribution System	2020	$ 4,975,000.00	$ -	$ -	$ 355,833.33	$ 2,868,142.86	$ 1,751,023.81	$ -
2020 Water Relay		Inactive	Water-Distribution System	2020	$ 1,720,000.00	$ -	$ -	$ 93,307.69	$ 1,473,692.31	$ 153,000.00	$ -
2021 Small Diameter Water Main Replacement		Inactive	Water-Distribution System	2020	$ 114,770,000.00	$ -	$ -	$ 4,767,777.78	$ 22,980,681.70	$ 77,378,441.10	$ 9,643,099.42
2020 Valve Replacement		Inactive	Water-Distribution System	2020	$ 6,805,000.00	$ -	$ -	$ 4,075,625.94	$ 2,729,374.06	$ -	$ -

Project Name	Project Number	Project Phase	Project Type	Project Start (Year)	Capital Project Budget	Actual 2018 Expenditures	Projected 2019 Expenditures	Projected 2020 Expenditures	Projected 2021 Expenditures	Projected 2022 Expenditures	Projected 2023 Expenditures
2020 Hydrant Replacement		Inactive	Water-Distribution System	2020	$ 1,430,000.00	$ -	$ -	$ 862,533.94	$ 567,466.06	$ -	$ -
2021 Unmetered and Flat Rate Properties		Inactive	Water-Distribution System	2021	$ 5,100,000.00	$ -	$ -	$ -	$ 364,166.67	$ 2,941,476.19	$ 1,794,357.14
2021 Water Relay		Inactive	Water-Distribution System	2021	$ 1,750,000.00	$ -	$ -	$ -	$ 93,307.69	$ 1,496,192.31	$ 160,500.00
2022 Small Diameter Water Main Replacement		Inactive	Water-Distribution System	2021	$ 120,060,000.00	$ -	$ -	$ -	$ 4,906,666.67	$ 23,962,887.22	$ 80,868,691.73
2021 Valve Replacement		Inactive	Water-Distribution System	2021	$ 6,920,000.00	$ -	$ -	$ -	$ 4,144,939.67	$ 2,775,060.33	$ -
2021 Hydrant Replacement		Inactive	Water-Distribution System	2021	$ 1,450,000.00	$ -	$ -	$ -	$ 872,533.94	$ 577,466.06	$ -
2022 Unmetered and Flat Rate Properties		Inactive	Water-Distribution System	2022	$ 5,245,000.00	$ -	$ -	$ -	$ -	$ 375,000.00	$ 3,023,809.52
2022 Water Relay		Inactive	Water-Distribution System	2022	$ 1,880,000.00	$ -	$ -	$ -	$ -	$ 100,307.69	$ 1,608,192.31
2023 Small Diameter Water Main Replacement		Inactive	Water-Distribution System	2022	$ 58,880,000.00	$ -	$ -	$ -	$ -	$ 2,411,111.11	$ 11,751,223.06
2022 Valve Replacement		Inactive	Water-Distribution System	2022	$ 7,150,000.00	$ -	$ -	$ -	$ -	$ 4,281,900.45	$ 2,868,099.55
2022 Hydrant Replacement		Inactive	Water-Distribution System	2022	$ 1,450,000.00	$ -	$ -	$ -	$ -	$ 872,533.94	$ 577,466.06
2023 Water Relay		Inactive	Water-Distribution System	2023	$ 1,880,000.00	$ -	$ -	$ -	$ -	$ -	$ 100,307.69
2023 Unmetered and Flat Rate Properties		Inactive	Water-Distribution System	2023	$ 5,360,000.00	$ -	$ -	$ -	$ -	$ -	$ 383,333.33
2024 Small Diameter Water Main Replacement		Inactive	Water-Distribution System	2023	$ 60,700,000.00	$ -	$ -	$ -	$ -	$ -	$ 2,485,555.56
2023 Valve Replacement		Inactive	Water-Distribution System	2023	$ 7,400,000.00	$ -	$ -	$ -	$ -	$ -	$ 4,432,450.98
2023 Hydrant Replacement		Inactive	Water-Distribution System	2023	$ 1,575,000.00	$ -	$ -	$ -	$ -	$ -	$ 946,847.66
2018 Curb Box Inspection Contract	2017-325-106-0	Construction	Water-Lead	2017	$ 2,980,134.11	$ 1,973,720.03	$ 563,078.18	$ -	$ -	$ -	$ -
2018 Lead Service Line Replacement Program	2018-325-100-0	Construction	Water-Lead	2018	$ 43,300,000.00	$ 14,436,085.08	$ 8,653,248.41	$ 1,936,232.12	$ -	$ -	$ -
2019 Lead Replacement Program	WS19-325-100-0	Procurement	Water-Lead	2018	$ 49,128,403.40	$ -	$ 25,317,733.45	$ 24,140,669.96	$ -	$ -	$ -
2019 Curb Box Inspections		Inactive	Water-Lead	2018	$ 3,960,000.00	$ -	$ 2,392,941.18	$ 1,545,882.35	$ -	$ -	$ -
2020 Curb Box Inspections		Inactive	Water-Lead	2019	$ 3,990,000.00	$ -	$ -	$ 2,214,404.76	$ 1,775,595.24	$ -	$ -
Bruecken Pump Station Valve Vault	2013-323-175-0	Construction	Water-Pumping and Storage	2014	$ -	$ 531,743.51	$ 1,710,942.26	$ -	$ -	$ -	$ -
Highland Reservoir Pump Station and Rising Main	2017-323-101-0	Design	Water-Pumping and Storage	2017	$ 37,130,000.00	$ 477,011.81	$ 1,249,028.48	$ 3,008,700.40	$ 14,887,591.29	$ 12,607,591.29	$ 3,021,265.21
Lanpher Reservoir Improvements	2017-323-105-0	Various	Water-Pumping and Storage	2017	$ 29,643,000.00	$ 10,679,967.52	$ 5,738,684.97	$ 11,095,926.74	$ -	$ -	$ -
Ross Pump Station	2018-323-101-0	Preliminary Design	Water-Pumping and Storage	2018	$ 43,000,000.00	$ -	$ 1,100,484.35	$ 2,406,666.67	$ 7,342,383.84	$ 13,544,363.64	$ 13,544,363.64
Aspinwall Pump Station to Lanpher Reservoir Rising Main	2018-323-100-0	Preliminary Design	Water-Pumping and Storage	2018	$ 49,454,000.00	$ 14,079.55	$ 2,093,783.66	$ 4,517,102.19	$ 23,939,949.90	$ 18,242,052.26	$ -
AWTP High Service Pumping		Scoping	Water-Pumping and Storage	2019	$ 53,620,000.00	$ -	$ 4,164,254.39	$ 2,794,262.36	$ 17,704,955.59	$ 17,704,955.59	$ 13,411,572.08
Garfield Tank Improvements		Scoping	Water-Pumping and Storage	2019	$ 4,050,000.00	$ -	$ 32,352.94	$ 528,235.29	$ 2,026,806.72	$ 1,462,605.04	$ -
Lincoln Tank Improvements		Scoping	Water-Pumping and Storage	2019	$ 4,195,000.00	$ -	$ 319,019.61	$ 1,215,910.36	$ 2,327,815.13	$ 332,254.90	$ -
Chlorine Booster Station Improvements		Scoping	Water-Pumping and Storage	2019	$ 10,090,000.00	$ -	$ 488,378.38	$ 966,756.76	$ 6,117,915.49	$ 2,516,949.38	$ -
Clearwell Improvements		Scoping	Water-Pumping and Storage	2019	$ 67,810,000.00	$ -	$ 747,656.25	$ 3,159,375.00	$ 4,134,375.00	$ 3,359,102.27	$ 32,129,284.09
Herron Hill Reservoir Improvements		Scoping	Water-Pumping and Storage	2019	$ 5,520,000.00	$ -	$ 636,559.14	$ 2,272,172.04	$ 2,611,268.82	$ -	$ -
Highland No. 2 Reservoir Improvements		Scoping	Water-Pumping and Storage	2019	$ 27,510,000.00	$ -	$ 2,936,216.22	$ 5,949,892.51	$ 13,084,960.69	$ 5,538,930.59	$ -
2019 Large Diameter Water Main Improvements (Rising Main S		Preliminary Design	Water-Pumping and Storage	2018	$ 23,550,000.00	$ -	$ 878,333.33	$ 2,324,166.67	$ 7,418,590.91	$ 10,971,409.09	$ 1,957,500.00
2020 Large Diameter Water Main Improvements		Inactive	Water-Pumping and Storage	2019	$ 11,940,000.00	$ -	$ 684,242.42	$ 1,261,590.91	$ 5,434,257.58	$ 4,559,909.09	$ -
Irvine Pump Station (Coral and Pacific) Improvements		Inactive	Water-Pumping and Storage	2020	$ 600,000.00	$ -	$ -	$ 53,000.00	$ 487,833.33	$ 61,388.89	$ -
Spring Hill Tanks Improvements		Inactive	Water-Pumping and Storage	2020	$ 2,125,000.00	$ -	$ -	$ 164,545.45	$ 642,154.32	$ 1,233,540.87	$ 9,759.36
2021 Large Diameter Water Main Improvements		Inactive	Water-Pumping and Storage	2020	$ 12,170,000.00	$ -	$ -	$ 689,696.97	$ 1,297,727.27	$ 5,544,393.94	$ 4,638,181.82
2022 Large Diameter Water Main Improvements		Inactive	Water-Pumping and Storage	2021	$ 12,430,000.00	$ -	$ -	$ -	$ 693,333.33	$ 1,321,515.15	$ 5,670,515.15
Mission Pump Station Improvements		Inactive	Water-Pumping and Storage	2022	$ 16,865,000.00	$ -	$ -	$ -	$ -	$ 995,714.29	$ 1,054,285.71
2023 Large Diameter Water Main Improvements		Inactive	Water-Pumping and Storage	2022	$ 13,010,000.00	$ -	$ -	$ -	$ -	$ 698,787.88	$ 1,357,651.52
Herron Hill Tank Pump Station Improvements		Inactive	Water-Pumping and Storage	2023	$ 1,110,000.00	$ -	$ -	$ -	$ -	$ -	$ 115,151.52
Herron Hill Pump Station Improvements		Inactive	Water-Pumping and Storage	2023	$ 10,960,000.00	$ -	$ -	$ -	$ -	$ -	$ 891,428.57
2023 Large Diameter Water Main Improvements		Inactive	Water-Pumping and Storage	2023	$ 13,400,000.00	$ -	$ -	$ -	$ -	$ -	$ 1,540,000.00
Howard Pump Station Improvements		Inactive	Water-Pumping and Storage	2023	$ 18,650,000.00	$ -	$ -	$ -	$ -	$ -	$ 404,761.90
Lincoln Pump Station Improvements		Inactive	Water-Pumping and Storage	2023	$ 3,165,000.00	$ -	$ -	$ -	$ -	$ -	$ 331,060.61
Saline Pump Station Improvements		Inactive	Water-Pumping and Storage	2023	$ 3,435,000.00	$ -	$ -	$ -	$ -	$ -	$ 359,848.48
Filter Rehab	2013-322-176-0	Construction	Water-Treatment Plant	2014	$ -	$ 1,485,468.40	$ 572,953.37	$ -	$ -	$ -	$ -
MFP Assessment and Critical Process Improvements	2017-322-104-0	Construction	Water-Treatment Plant	2017	$ 1,755,500.00	$ 1,188,020.70	$ -	$ -	$ -	$ -	$ -
Highland Park Membrane Filtration Module Replacement Prog	2017-322-105-0	Construction	Water-Treatment Plant	2017	$ 1,452,711.00	$ 52,403.83	$ 460,118.50	$ 459,618.50	$ -	$ -	$ -
Aspinwall and MFP Fiberglass Reinforced Plastic Chemical Tank	2017-322-102-0	Construction	Water-Treatment Plant	2017	$ 294,000.00	$ 142,826.48	$ 94,845.00	$ -	$ -	$ -	$ -
Highland Park Membrane Filtration Plant UV System	2017-322-106-0	Construction	Water-Treatment Plant	2017	$ 5,855,000.00	$ 641,342.70	$ 2,474,862.40	$ -	$ -	$ -	$ -
Corrosion Control Chemical Storage & Feed Systems	2017-322-107-0	Design	Water-Treatment Plant	2017	$ 4,445,000.00	$ 699,809.50	$ 3,368,142.02	$ -	$ -	$ -	$ -
Aspinwall Treatment Plant Pretreatment Chemical System and	2017-322-101-0	Various	Water-Treatment Plant	2017	$ 28,370,000.00	$ 1,186,824.83	$ 4,501,411.01	$ 7,073,255.89	$ 7,701,822.92	$ 5,717,343.32	$ 1,776,088.24
Clearwell Emergency Response Project	2017-323-100-0	Preliminary Design	Water-Treatment Plant	2017	$ 27,670,000.00	$ 864,095.11	$ 411,168.20	$ 727,938.41	$ 13,565,797.10	$ 11,469,014.49	$ -
Aspinwall Water Treatment Plant Electrical and Backup Power	2017-322-100-0	Preliminary Design	Water-Treatment Plant	2017	$ 26,520,000.00	$ 341,120.04	$ 857,392.21	$ 1,342,659.39	$ 8,503,855.78	$ 8,503,855.78	$ 6,456,110.22
Aspinwall WTP Raw Water Intakes	2018-322-100-0	Preliminary Design	Water-Treatment Plant	2018	$ 45,000,000.00	$ -	$ 1,162,913.40	$ 2,506,666.67	$ 7,666,816.74	$ 14,152,623.38	$ 14,152,623.38

Project Name	Project Number	Project Phase	Project Type	Project Start (Year)	Capital Project Budget	Actual 2018 Expenditures	Projected 2019 Expenditures	Projected 2020 Expenditures	Projected 2021 Expenditures	Projected 2022 Expenditures	Projected 2023 Expenditures
Highland Park Membrane Filtration Floor Drainage Modificatio		Inactive	Water-Treatment Plant	2020	$ 870,000.00	$ -	$ -	$ 115,217.39	$ 712,512.08	$ 42,270.53	$ -
				Total	$ 1,803,113,727.60	$ 52,640,978.08	$ 125,698,431.02	$ 245,659,209.72	$ 348,498,588.70	$ 349,337,221.95	$ 312,909,055.04

Exh. RAW/C-15

DOCUMENT 00010

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C-451 Qualifications Statement
C-410 Bid Form
C-520 Agreement
C-700 General Conditions
C-800 Supplementary Conditions – Modifications to General Conditions
Material Disposal Plan
Exhibit B MBE/WBE Solicitation & Commitment Forms
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DIVISION 3 – CONCRETE

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03600 Grout

ATTACHMENTS *[note: may include Geotech reports, environmental reports, etc]*
ATTACHMENT A – PITTSBURGH STANDARD DETAILS *[note yearly contracts/IDIQ contracts included where site specific details are not included in the Contract Drawings]*
ATTACHMENT B – PITTSBURGH DPW RIGHT-OF-WAY MANUAL

END OF SECTION

Request for Proposals for the Lanpher Redundant Rising Main Project

PWSA PROJECT NO. PWSA104

August 2018

Request for Proposals for the
Lanpher Redundant Rising Main Project

PWSA PROJECT NO. PWSA104

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Request for Proposals for the
Lanpher Redundant Rising Main Project

PWSA PROJECT NO. PWSA104

1. **BACKGROUND AND INTENT:** The Pittsburgh Water and Sewer Authority (PWSA) currently serves 83,000 drinking water connections and 113,000 sewage service connections. In addition, PWSA also provides bulk water sales to municipalities including Reserve Township, Fox Chapel Borough, and Aspinwall Borough, along with being interconnected to several other regional water systems. PWSA's drinking water system consists of five reservoirs, two water treatment plants, 11 pump stations, 11 tanks, and approximately 1,000 miles of water lines. In addition, PWSA's sewer system is comprised of four booster pumping stations and approximately 1,200 miles of sewer lines. PWSA has about 260 employees across six locations with the main headquarters located at 1200 Penn Ave., Pittsburgh, PA, 15222.

   The existing 60-inch riveted steel Lanpher Rising Main conveys water from the Aspinwall Water Treatment Plant to the Lanpher Reservoir. There are two (2) major connections, Waterworks Mall and the UPMC St. Margaret Hospital located in Aspinwall, PA, and six (6) other connections along the route of the rising main.

   The existing Lanpher Rising Main has served PWSA for more than 100 years. PWSA is proposing to construct a redundant rising main to the Lanpher Reservoir located in Shaler Township. The proposed redundant rising main will commence at the existing Aspinwall Pump Station located at the PWSA's Aspinwall Water Treatment Plant (AWTP) and extend approximately 22,500 linear feet (LF) to the Lanpher Reservoir. This project is an important component of PWSA's current Capital Improvement Program (CIP) as it will provide required disinfection contact time (CT) for finished water during implementation of the Clearwell Bypass while the existing Clearwell is being replaced and establishes redundancy for the oldest rising main in the system. The proposed Lanpher Redundant Rising Main will deliver treated water to the Lanpher Reservoir without any interconnections to the distribution system during the Clearwell replacement; however, it will still need to capable of servicing several bulk water customers, as currently being performed by the existing rising main, after the Clearwell is replaced.

   The project will be constructed through the following municipalities:

   - City of Pittsburgh
   - Borough of Aspinwall
   - Borough of Sharpsburg
   - Borough of Etna
   - Shaler Township

   The alternative locations of the anticipated rising main routing are shown in the attached Figures 1 and 2. These figures were derived from the document prepared by Mott MacDonald titled "Lanpher Rising Main Feasibility Report" dated October 2016 which is attached to this Request for Proposal (RFP). The CONSULTANT will be responsible to evaluate the anticipated route and provide recommendations to PWSA for consideration of the final route selection.

2. **PURPOSE:** Through the issuance of this RFP, PWSA is seeking qualified design firms that are financially and technically qualified to perform the scope of services as described herein. PWSA is interested in those firms that provide innovative solutions to the challenges of constructing this pipeline through heavily congested neighborhoods. PWSA is looking for firms that have experience in design and construction of large diameter transmission mains, trenchless technologies and can exhibit cost savings and schedule acceleration.

   The purpose of the Lanpher Redundant Rising Main Project is for the CONSULTANT to:

   A. Progress the Lanpher Rising Main Feasibility Report, dated October 2016, as prepared by Mott MacDonald, LLC by:

      1. Reviewing all relevant previously completed reports and designs for the proposed redundant rising main.

      2. Working collaboratively with PWSA and stakeholders to determine the most efficient and constructible route for the proposed redundant rising main.

      3. Identifying any field investigations, in addition to those specifically stated in this RFP, including surveys and geotechnical analysis, needed to advance this design to final construction documents.

      4. Conducting extensive utility coordination, including subsurface exploration, as described herein and any additional coordination as proposed by the CONSULTANT, with PennDOT and any railroad to identify key conflicts that may arise as part of this project.

      5. Identify all required easements, whether temporary or permanent, and prepare necessary documents for acquiring said easements. Assist PWSA in the acquisition of said easements.

      6. Prepare a Phase I Environmental Site Assessment (ESA) in accordance with ASTM 1527-13. The ESA shall be performed for the entire length of the route of the proposed redundant rising main.

      7. Performing additional field investigations and desktop analyses (e.g. hydraulic and hydrologic modeling), as applicable, to expand beyond the feasibility stage.

   B. Develop design and bid packages, including design drawings, specifications, construction cost estimate and schedule for the selected pipeline route. The CONSULTANT shall advance the design through the 30%, 60%, 90%, and final (bid) design stages.

C. Identify required permits for construction and prepare applications for those that can be completed by the CONSULTANT.

D. Provide bidding and construction design phase services, specifically excluding construction management and inspection services.

3. **SCOPE OF WORK:** The CONSULTANT shall do all the work and furnish all supervision, labor, materials, equipment, tools and appurtenances necessary or proper for the performance and completion of the following:

Preliminary Design Report

A. The CONSULTANT will review the previously prepared feasibility report on preliminary route evaluations. CONSULTANT shall confirm the sizing and material of the proposed redundant rising main. Two of the previously identified routes for the Lanpher Redundant Rising Main will be reviewed by the CONSULTANT to identify if any conditions have significantly changed since the October 2016 Feasibility Report was prepared. The factors considered during the sizing and preliminary route evaluation should include, but not be limited to:

1. Factors Affecting Constructability and Cost;
2. Permitting;
3. Risk Assessment;
4. Construction Techniques;
5. Duration of Construction (Potential Delays);
6. Utility, Roadway and Railroad Impacts;
7. Trenchless Crossings;
8. Easements Required; and
9. Ability to obtain Easements.

B. The CONSULTANT will be required to conduct field or desktop investigations necessary to determine the information listed above that may affect the construction of the redundant rising main.

C. A Preliminary Design Report which summarizes the findings, conclusions and recommendations of the preliminary route evaluation must be provided under this Task. The report shall rank each alternative based upon the factors identified and provide a recommendation on the highest ranked alternative. Additional factors may be added at the CONSULTANT's discretion.

D. This task will include at least one workshop, additional if necessary, with PWSA to discuss the alternatives analysis and review the potential routes and obtain consensus on the preferred route. CONSULTANT may have to revise and resubmit the report based on discussions during the workshop(s). It is anticipated a decision will be made by

PWSA on the preferred route as a result of the workshop(s) and when the report has been finalized.

Final Design and Permitting

Final design, Contract Documents (Plans and Specifications) and required permitting and easement acquisition support, will be prepared as part of this task. The CONSULTANT will be required to provide all civil/site, geotechnical and mechanical, design services, including permitting and field investigations, required for the design of the new Lanpher Redundant Rising Main.

A. Surveying of Proposed Route.

1. The survey shall include existing utility investigation and coordination, performing PA One Call, subsurface utility investigations of existing utilities, and any other investigation necessary to meet the standards of American Society of Civil Engineers (ASCE) 38-02 to minimize/avoid utility conflicts. The CONSULTANT shall develop a plan for subsurface utility investigations. Following the investigations, the CONSULTANT shall submit to PWSA, in electronic format, a report describing all findings.

2. The survey shall include sufficient width throughout the alignment to complete the project design. The additional width areas may include trenchless crossings, utility conflicts, laydown areas, etc.

3. Existing features and topographic information at 1-foot contour intervals shall be provided. Topographic information shall be referenced to NAVD88 and the survey shall be set to Pennsylvania State Plan coordinates (NAD83 State Plane South). Bench marks and permanent survey monument information to be defined as existing/established on the base site survey.

4. The survey files shall provide a complete representation of existing utilities, taking into account surveyed data points, markings, one-call data, and any other utility information. Utility data must be complete, with no breaks or gaps in line work. Existing utility lines must be labeled with the owner, type of utility, diameter or size, if known, and pipe or conduit material, if known.

5. The survey shall be signed and sealed by a registered Professional Surveyor in the Commonwealth of Pennsylvania.

6. Conduct property and right-of-way research associated with the proposed route and alignment.

7. Coordination and preparation of potential construction and permanent easements or similar documents.

8. Potholes to determine utility depths will be surveyed as required.

B. Phase I Environmental Site Assessment

1. CONSULTANT shall prepare a Phase I ESA for the entire route of the proposed redundant rising main. The ESA shall be performed in accordance with ASTM 1527-13 and any updates.

2. The CONSULTANT shall identify and make recommendations as to the need to perform any further investigations, including preparation of a Phase II ESA, for any portion of the proposed route. The recommendations shall include specific justification as to the need for additional investigations.

3. The CONSULTANT shall coordinate the results of the Phase I ESA with the Geotechnical Investigation discussed below, as to include initial, limited, environmental sampling, if applicable. Initial assumptions for limited environmental sampling and analysis shall be clearly stated in the CONSULTANT's proposal and shall be provided as a separate cost item within the CONSLTANT's fee proposal. CONSULTANT shall request PWSA's approval prior to collection of samples. The sampling results shall be presented within the Phase I Report. Recommendations for additional sampling and analysis that best define additional environmental due diligence scope shall be presented to best inform the final design.

4. Any proposed additional investigation or preparation of a Phase II report is beyond the scope of this RFP and will be negotiated separately.

C. Geotechnical Investigation.

1. A minimum of three (3) borings must be completed at each of the trenchless crossings No. 1 and No. 2. Trenchless Crossing No. 3 should include up to ten (10) borings.

2. The locations of the anticipated trenchless crossings are shown on Figures 1 and 2. The CONSULTANT will be responsible for determining the actual number, locations and depth of the borings required for the design. Any additional trenchless crossings or installations proposed by the CONSULTANT will require a similar number of borings. The borings shall be of sufficient depth to incorporate the soil conditions at the proposed elevation of the trenchless crossings. It is anticipated that all the trenchless crossing borings will include rock core samples.

3. Borings along the open cut segments shall be performed at a spacing of approximately 500 feet to provide a general understanding of the subsurface conditions. Boring logs should be prepared with the classification of the soils at each boring and include blow counts and depth to groundwater. A boring location plan should be prepared and submitted to the PWSA for approval prior to the start of the boring field work.

4. Laboratory testing will need to be performed on each sample collected at the trenchless crossings to obtain data on moisture content, Atterberg limits, particle size (sieve and hydrometer analysis), and unconfined compressive strength for cohesive soil. These analyses shall be used in the design of the

trenchless crossings.

5. The laboratory testing shall also include obtaining data to evaluate the likelihood of corrosive soils by performing a corrosivity study of the underlying soils. The study should be performed in accordance with the Ductile Iron Pipe Research Association (DIPRA) guidelines and should evaluate corrosion potential of soils by examining resistivity, redox potential, pH, sulfides and moisture content. Testing of soil samples should also include total acidity, sulfates and chlorides at any location where there is a potential for the use of pre-stressed concrete pipe.

6. Submit a report summarizing and interpreting the results, signed and stamped by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania. CONSULTANT shall be responsible for coordinating all drilling activities with One-call system and any other utility locating service (see paragraph 1.a above) and shall be responsible for any damage to existing utilities.

D. Evaluation of Pipe Material and Pressure Class

1. Evaluate pipe material to be utilized for construction of the redundant rising main and provide recommendation. The proposed redundant rising main must be designed to meet external loads (soil loadings and dead/live loads above the pipe) and internal pressures. The pipe materials to be evaluated include ductile iron, steel, and pre-stressed concrete cylinder pipe.

2. Perform calculations to determine required pipe pressure class and select appropriate pressure class, including an appropriate factor of safety which meets industry standards for the chosen pipe material. An excerpt from PWSA's hydraulic model of the proposed pipeline alignment will be provided to the CONSULTANT. Further analysis of the model will be required to support the selection of the pipe pressure class, design for transients, and size and locate appropriate air/vacuum release valves and shall be performed utilizing Bentley's WaterGEMS and Hammer. A report which summarizes the results of the hydraulic and transient modeling should be provided to PWSA in electronic format as part of the calculations package to be submitted as part of every design phase.

3. Discuss recommendation of pipe material and pressure class with the PWSA in workshop to determine final selection for design. Note, it may be advantageous to include alternative materials in the bidding process to obtain competitive pricing.

E. Pipeline Plans and Details

1. Plans shall be drawn at a scale not more than 1" = 20' and shall include project stationing and appropriate features (pipe, valves, road names, cartways, curbs, traffic controls, utilities, ground cover, etc.) to properly reflect project conditions.

2. Profiles of the alignment must be provided at a vertical scale of 1" = 5' or

1" = 10', depending on the topography, and located on the same plan sheet as the plan view. A minimum four (4) feet of cover shall be provided for the proposed rising main.

3. A key map shall be provided on each sheet to indicate the section of pipeline shown on that sheet in relation to the overall alignment. A legend should be included on each sheet or as a dedicated sheet.

4. Detail sheets should be linked to each page where the detail is called out using a bubble split in half. The top half indicates the detail number and bottom half indicates the sheet number where the detail is located.

5. Detailed designs of the tie in points of proposed redundant rising main at the Aspinwall Pump Station and at Lanpher Reservoir must be prepared. The configuration of the connections at each location shall be coordinated with PWSA. Potential layouts of these connections are provided in Figures 3 and 4. CONSULTANT is responsible for the design of all required facilities, including valves vaults, and developing the procedure for the completion of the connections.

6. Detailed design of tie in points with all service connections (same as connections with the existing rising main) must be prepared. The configuration of the connections at each location shall be coordinated with the PWSA. CONSULTANT is responsible for the design of all required facilities, including valves vaults, and developing the procedure for the completion of the connections during construction.

7. Include cross sections and details of critical locations such as intersections, connection points and trenchless crossings. The cross sections should include all existing and proposed features.

8. Include detailed design and locations of all proposed air release valves and blow off valve assemblies and associated valve vaults.

9. For each proposed trenchless crossing provide separate plan and detail sheets to sufficiently detail the designs of each crossing. Appropriate diameter carrier/casing pipe shall be used at all crossings. CONSULTANT may propose, with sufficient analysis and justification, the use of horizontal directional drilling. If acceptable to PWSA, casing pipe will not be required.

10. The civil design shall include all clearing and grubbing, stormwater and erosion control, maintenance of traffic, grading, excavation, subgrade preparation, backfill, site restoration and pavement restoration associated with the installation of the new Lanpher Redundant Rising Main.

11. Details shall be provided for all redundant rising main appurtenances and proposed improvements and shall conform to PWSA's standards or as otherwise approved by PWSA.

12. The plan and detail sheets shall be signed and sealed by a registered Professional Engineer in the Commonwealth of Pennsylvania.

13. Plans and associated detail sheets shall be submitted at 30%, 60%, 90% and 100% completion for review by the PWSA.

a) Preliminary Design Phase (30 Percent) – The CONSULTANT shall prepare a preliminary redundant rising main routing plan for the proposed transmission main. The routing plan shall include, without limitation, an identification of the size and location of all existing and proposed easements/properties for the proposed transmission main, the nature, size and location of existing utilities, potential conflicts/project challenges, an analysis of the geotechnical conditions, anticipated construction difficulties, the recommended configuration for the proposed pipeline, the location and method of construction for the trenchless crossings, the methods of connection for all tie-in points, and a summary of the permits which will be required to construct the pipeline. The preliminary design shall also include the development of any corrosion control measures that may be required due to insitu soil and environmental conditions and the type of pipe being proposed. All details for a suitably designed corrosion protection system shall be included in the Contract Documents. A project phasing plan and schedule, table of contents for the technical specifications and preliminary Opinion of Probable Construction Cost (OPCC), Association for the Advancement of Cost Engineers (AACE) Level 4, shall be provided. All relevant design calculations shall be provided.

(1) PWSA will provide written comments on the preliminary design submittal within four weeks.

(2) A workshop will be held to review the preliminary design and comments.

(3) CONSULTANT shall provide written responses to all comments.

b) 60 Percent Design Phase – The CONSULTANT shall incorporate PWSA's comments from the preliminary design (30 percent) submittal. Resolutions of comments shall be documented in the Design Comment Review Log provided by PWSA.

(1) Drawings shall depict the design, be suitable for submission to permitting agencies, and shall, at a minimum, include the following:

a. Cover sheet.
b. General notes, location plan, legend, and drawing index sheet(s).
c. Survey coordinate control plan sheet(s), including monuments, control points, and northing and eastings.
d. Plan and profiles sheets, including dimensions, labeling, and sheet related notes.
e. Demolition plan sheets, as applicable.
f. Detail sheets, including erosion and sedimentation control.
g. MPT Plan for submission to appropriate agencies for approval.
h. Preliminary construction phasing plan, if applicable, presenting sequencing of construction operations and

interdependencies of activities.

(2) Draft of all sections of technical specifications.

(3) OPCC, AACE Level 3.

(4) Right-of-way and/or construction easement exhibits, if applicable.

(5) Updated calculations package

(6) List all deviations from the preliminary design.

(7) Updated construction schedule presenting sequencing of construction operations and interdependencies of activities.

(8) PWSA will provide written comments on the preliminary design submittal within two weeks.

(9) A workshop will be held to review the 60 percent design and comments.

(10) CONSULTANT shall provide written responses to all comments.

c) 90 Percent Design Phase – The CONSULTANT shall prepare Design Documents at the 90 Percent Design milestone in accordance with all applicable permit conditions based on the information derived during the 60 Percent Phase and as approved by PWSA. The design documents shall generally include separate technical specification sections and drawings. The drawings shall include required traffic control, erosion and sedimentation control, and restoration plans. An updated calculations package, construction schedule and OPCC, AACE Level 2, shall be provided by the CONSULTANT.

(1) PWSA will provide written comments on the preliminary design submittal within two weeks.

(2) A workshop will be held to review the 90 percent design and comments.

(3) CONSULTANT shall provide written responses to all comments.

d) 100 Percent Design/Bid Ready Phase – Based on the PWSA's approval of the 90 Percent Design Documents, the CONSULTANT shall prepare 100 Percent Design Documents in support of PWSA's bidding of the Project. These 100 Percent Design Documents shall by sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania and consist of drawings and specifications setting forth in detail the quality levels of materials and systems and other requirements for the construction of the Project, including, but not limited to, the work required for the general, civil/site, geotechnical, mechanical, structural, and Division 01 of the Bidding Documents. An OPCC, AACE Level 1 and anticipated construction scheduled shall be provided by the CONSULTANT. The CONSULTANT shall be responsible for revising the 100% Design Documents in accordance with comments from PWSA or its representatives to develop and submit the final, Bid-Ready set of bidding documents.

F. Meetings

1. At a minimum, the CONSULTANT shall anticipate the following meetings:

a) Project kick-off;
b) Monthly Project Status;
c) 30% Design Review;
d) 60% Design Review;
e) 90% design Review;
f) 100% Design/Bid Ready Review; and
g) Meetings with Pennsylvania Department of Environmental Protection (PADEP), Stakeholders, Municipalities, Utilities, and other Public Meetings.

2. CONSULTANT shall estimate and document in their proposal the logic used to determine the number of meeting required for item (7) above.

3. The proposed dates for the design milestone meetings should be included in the Proposed Project Schedule required below.

4. Design meetings will be conducted at the PWSA's 1200 Penn Avenue, Pittsburgh, PA 15222 office. The CONSULTANT is to determine which team members should attend these meetings but should include as a minimum, the Project Manager and no more than two others that have direct involvement with the project. PWSA may elect to conduct additional design meetings beyond the meetings identified above or elsewhere in this RFP. Such additional meetings shall be billed by CONSULTANT at the unit labor rates presented in its Proposal, unless otherwise approved by the PWSA in writing. At the meetings, the CONSULTANT shall be prepared to discuss project status including, but not limited to:

a) Current pipeline route and any changes from previous alignment;
b) Easements and permitting;
c) Risk Assessment;
d) Municipality and Public meetings;
e) Development of project drawings and specifications;
f) Selection of materials;
g) New and revised cost impacts;
h) Investigative data collected and the associated impacts of the findings;
i) Design changes and/or project challenges;
j) Progress as compared to the project schedule; and
k) Other subjects as needed.

5. CONSULTANT's Project Manager shall be expected to communicate project status and outstanding issues biweekly throughout the project performance. These meetings shall be informal but provide the means to assess the status of the project, and to assure that needed information is expeditiously communicated between the parties.

6. CONSULTANT shall submit draft minutes of all meetings, formal and informal, and workshops to PWSA for review and comment within two working days. Final minutes shall be emailed to all participants and posted on eBuilder within two days of receipt of comments.

G. Traffic Control Plans

1. Traffic control is a significant consideration during the project design and associated construction. A traffic control plan shall be developed for the overall construction project, including all roadways. The traffic control plan shall be designed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and PennDOT Publication 213.

2. A separate set of traffic control plans shall be prepared for all PennDOT roadways affected by the proposed construction. The PennDOT traffic control plans will be submitted as part of the Highway Occupancy Permit application to PennDOT.

H. Permitting

1. The CONSULTANT shall prepare all regulatory permit applications to allow construction to proceed in a timely manner. CONSULTANT shall provide all executed copies of permit applications and supporting documentation, signed and sealed by a registered Professional Engineer in the Commonwealth of Pennsylvania, to PWSA for submittal. PWSA will pay all required application fees and make agency submittals. CONSULTANT shall support PWSA with response to agency comments and make permit and design revisions as required. CONSULTANT shall be responsible to identify and/or obtain all required permits and accompanying documentation for the project including, but not limited to, the following:

a) Municipal permits;

b) PennDOT Highway Occupancy Permits for all work within PennDOT rights-of-way;

c) Allegheny County Conservation District – Erosion and Sediment Control/NPDES Permit;

d) PADEP Permits – General Permit for Utility Line Crossing of Stream, Public Water Supply Permit;

e) US Army Corp of CONSULTANTs – Joint Permit for Stream Crossing;

f) Railroad Crossings – Occupancy Permits; and

g) Any other permits, such as wetland crossing, that may be required.

I. Easements

1. CONSULTANT shall prepare all required legal documentation for both temporary and permanent easements, signed and sealed as required, that are required as part of this project. Documentation includes, but is not limited to, 8-1/2" x 11" sheets with meets and bounds and written descriptions. This

documentation will be used by the PWSA legal team to negotiate the easement and eventually to file with the property deed at the courthouse.

J. Municipal/Public Coordination

1. Conduct meetings with each affected municipality and public, as needed, to review the proposed project. It is anticipated at least one (1) meeting will be conducted with each municipality and as many public meetings necessary for the entire route of the proposed pipeline. Scheduling of the meetings shall be done by the PWSA Community Relations staff. The CONSULTANT shall be responsible for developing the appropriate Power Point slides, handouts, etc. for the meetings.

2. At least two weeks prior to the meeting with a municipality or public, the CONSULTANT shall provide PWSA a copy of the presentation for review and comment.

3. CONSULTANT shall be responsible for preparing minutes from all meetings. Draft minutes shall be provided to PWSA, both electronically and in eBuilder, within two (2) days of the meeting. CONSULTANT shall incorporate comments and submit the final document to eBuilder.

4. Incorporate any comments, as agreed to by PWSA and the municipality, into the design plans.

K. Contract Documents

1. Prepare contract documents utilizing Construction Specifications Institute (CSI) MasterFormat 2004 (50 Divisions) specifications. Specifications will include technical specifications for all included work items.

2. PWSA will prepare the following "Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract" documents: Public Advertisement; EJCDC® C-200 – Instructions to Bidders for Construction Contracts; C-451 – Qualifications Statement; C-410 – Bid Form, with the exception of "Article 5 – Basis of Bid; C-520 – Agreement, with the exception of "Article 5 – Contract Price"; C-700 Standard General Conditions of the Construction Contract; C-800 - Supplementary Conditions (Owner modifications to the General Conditions only); Material Disposal Plan; Equal Opportunity Policy – MBE/WBE/VBE/SDBE; Equal Opportunity Plan Exhibit I – Broker Regulations; Equal Opportunity Plan Exhibit II – Solicitation and Commitment Statement; Performance Bond; Bid Bond; and Labor and Material Bond.

3. CONSULTANT shall prepare the following "Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract" documents: "Article 5 – Basis of Bid" of EJCDC® C-410 – Bid Form; "Article 5 – Contract Price" of C-520 – Agreement; C-800 - Supplementary Conditions (Project specific modifications, if applicable); and the Prevailing Wage Determination Schedule(s).

L. Project Coordination

1. Coordinate with design and construction phase activities associated with other PWSA CIP projects. The CONSULTANT shall attend and participate in any PWSA meeting with other Consultants performing design or construction phase services that may influence this particular project. For budgetary purposes, CONSULTANT shall assume a total of five (5) meeting lasting two (2) hours for two (2) people.

Bidding Phase Services

A. Following PWSA's approval of the bid ready documents, the CONSULTANT shall assist PWSA in the following:

1. Attend and participate in a pre-bid meeting;

2. Review, analyze, and provide answers and clarifications to questions, as requested by PWSA. CONSULTANT shall be prepared to make updates to drawings and/or specifications via addenda or provide clarifications as required to address questions raised during the bid period. All responses shall be provided in a timely manner to meet bid period deadlines.

3. Reviewing responsiveness of submitted bids; and,

4. Assisting PWSA to determine the successful bidder.

Coordination During Construction

A. The selected CONSULTANT shall advise and consult with PWSA throughout the course of the construction activities for the project.

1. Visit the site not more than twice per month while work is in progress to familiarize itself with the progress and quality of the work performed;

2. Attend progress meetings at least once a month at the PWSA offices to provide support and respond to technical concerns. Progress meeting minutes will be prepared by others;

3. Coordinate with PWSA's Project Manager/Construction Manager as necessary regarding the project;

4. PWSA's Construction Manager will be responsible for preparing the as-built drawings.

B. Submittals: All submittals will be handled through PWSA's eBuilder system.

1. CONSULTANT shall provide support to PWSA in reviewing submittals from the Contractor to ensure all aspects of construction adhere to the contract plans and specifications. This includes, but is not limited to, the submittal registry, schedules, shop drawings, sub-contractors, material testing plans and results, and requests for substitutions and "or-equal" materials and equipment proposed by the Contractor.

2. CONSULTANT will advise or take appropriate action upon receipt of required Contractor submittals, shop drawings, and product data. A written response shall be provided to PWSA for each submittal reviewed, identifying no exceptions taken, or exceptions or noncompliance with applicable requirements, no later than fifteen (15) calendar days of receipt from PWSA.

C. Requests for Information (RFIs), Field Instruction Directives, or Bulletins: CONSULTANT shall provide responses to contractor questions in e-Builder within five (5) calendar days of receipt of notification. Responses may require changes to specifications and/or drawings.

D. PWSA's Construction Manager will provide day-to-day observation on the progress of construction, not the CONSULTANT.

4. SCHEDULE

The CONSULTANT shall prepare and submit a project schedule that identifies all tasks required for all services covered by the Contract (minimum tasks shown below) and clearly indicates the critical path activities. The schedule shall be updated monthly and compared against the original baseline. At a minimum, unless otherwise stipulated, the schedule shall include the following timeframe for PWSA review and comment:

A. Preliminary Design Report: 15 business days.
B. 30% Design: 35 business days
C. 60% Design: 20 business days.
D. 90% Design: 15 business days.

Task	Calendar Days from Issuance of NTP
Notice to Proceed (NTP) Issued by PWSA	
Preliminary Design Report (Task 1) Complete	
30% Design Complete	
60% Design Complete	
90% Design Complete	
100% Design Complete	
Bid-Ready Contract Documents*	
Bidding Phase Complete	
Construction Phase Complete	

* All applicable Permits shall be approved at this point

5. PROJECT DELIVERABLES

A. At 30%, 60%, 90% and 100% completion CONSULTANT shall upload electronically to PWSA's eBuilder system, both as an Action Item for PWSA review as well as in the Documents Section 03.01, the following:

1. Design Plans and Specifications;
2. Design calculations;
3. OPCC;
4. Project schedule; and
5. Meeting minutes.

B. *All permit documents shall be provided to PWSA for review and approval via* eBuilder prior to submission to reviewing agencies. Permits shall be submitted as soon as practical in order to expedite execution of the project. CONSULTANT shall submit a permit submittal plan that highlights expected permit submittals.

C. Project Deliverables: The CONSULTANT shall upload all electronic files to the appropriate folder in e-Builder. The following table includes major deliverables, other deliverables may be required that are identified within the RFP but not listed below.

Deliverable	**Electronic Format**	**Hard Copies (number & size, if applicable)**	**Additional Requirements**
Project Schedule	Adobe PDF, Microsoft Project	N/A	None
Meeting Minutes	Adobe PDF	N/A	None
Design Calculations	Microsoft Excel, Adobe PDF	1	Final calculations signed and sealed by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania
Maps (e.g. geotechnical boring locations, etc.)	Adobe PDF, ESRI Arc GIS Geodatabase	N/A	Include hard copies in Preliminary Design Report
Graphics, renderings, and photos for Municipality/Public Meetings	jpeg	N/A	Minimum resolution shall be 300 dpi.
Survey, including traverse and control points and paths	MicroStation, Microsoft Excel.csv file	2, 24"X36"	Signed and sealed by a registered Professional Land Surveyor licensed in the Commonwealth of Pennsylvania, Microsoft Excel .csv file to include traverse and control points and paths with all

Deliverable	**Electronic Format**	**Hard Copies (number & size, if applicable)**	**Additional Requirements**
			point northing and eastings.
Geotechnical Report	Adobe PDF	1	Signed and sealed by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania
Preliminary Design Report	Adobe PDF	1	Signed and sealed by a registered Professional Report licensed in the Commonwealth of Pennsylvania
Design Comment Review Logs	Microsoft Excel	N/A	
Permit Applications	Adobe PDF	1	Signed and sealed by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania
Drawings			
Preliminary Design (30%)	Adobe PDF		
60% Submittal	Adobe PDF	3, 11"X17"	
90% Submittal	Adobe PDF	5, 24"X36"	
Final Submittal	Adobe PDF & MicroStation	5, 24"X36", (paper) 1, 24"36" (mylar)	Signed and sealed by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania
Specifications			
Preliminary Design (30%)	Microsoft Word	N/A	Table of contents only
60% Submittal	Microsoft Word	N/A	Modify guideline documents using track changes
90% Submittal	Microsoft Word	N/A	Modify guideline documents using track changes
Final Submittal	Adobe PDF & Microsoft Word	5	Front cover signed and sealed by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania

Deliverable	Electronic Format	Hard Copies (number & size, if applicable)	Additional Requirements
Opinion of Probable Cost			
Preliminary Design (30%)	Microsoft Excel	N/A	AACE Level 4
60% Submittal	Microsoft Excel	N/A	AACE Level 3
90% Submittal	Microsoft Excel	N/A	AACE Level 2
Final Submittal	Adobe PDF & Microsoft Excel	5	AACE Level 1
Construction Schedule	Adobe PDF, Microsoft Project	N/A	
Operations & Maintenance Manual, if applicable	Adobe PDF, Microsoft Word	2	

6. **MILESTONES:** See Section 4, "Schedule".

7. **MEETINGS:** See Scope of Work, Final Design and Permitting, Paragraph E, "Meetings".

8. **CONTRACT TERM:** The contract term shall be mutually agreed prior to execution of the Contract.

9. **CONTRACT ADMINISTRATOR:** This Contract will be administered by Nicole Dickun, Procurement Manager, 1200 Penn Ave., 2nd Floor, Pittsburgh, PA, 15222, telephone number (412) 255-8800 x8613, e-mail: ndickun@pgh2o.com. Questions pertaining to this Contract before and after award shall be directed to Ms. Dickun, or her designated representative. All questions are due five business days prior to the proposal due date/time. **CONTACT WITH ANYONE OTHER THAN PROCUREMENT REGARDING THIS SOLICITATION WILL BE CAUSE FOR YOUR FIRM'S RESPONSE TO BE REJECTED AND NO FURTHER CONSIDERATION WILL BE GIVEN (NO EXCEPTIONS).**

10. **PRE-PROPOSAL MEETING**: All Offerors interested in submitting a proposal in response to this solicitation are invited to attend a Pre-Proposal Meeting, to be held on August 21, 2018 at 10:00 a.m. in the Authority's Conference Room, 1200 Penn Ave., Pittsburgh, PA, 15222. The purpose of this meeting is to give an overview of the contract requirements and to allow Offerors to ask questions.

11. **PROPOSAL DUE DATE/TIME:** All Proposals are due no later than September 4, 2018 at 4:00 p.m. EST. All late and/or electronically submitted Proposals will be rejected and not considered for award.

12. BOND REQUIREMENTS: No bonds are required.

13. PROPOSAL SUBMISSION AND EVALUATION:

A. PROPOSAL SUBMISSION: The Authority shall utilize the Request for Proposals in accordance with the Policies and Procedures for Professional or Personal Services Contracts Policy.

The submission of proposals is as follows: Each Technical Proposal must be submitted with an original and seven copies, all of which must include the information requested herein. The technical information must conform to the basic or essential requirements set forth herein and shall include a Letter of Transmittal, signed by a duly authorized representative of the Offeror submitting the Proposal.

The sealed envelope must be clearly marked as follows:

Part I: Technical Proposal
Request for Proposals for
PWSA Project No. PWSA104 for the
Lanpher Redundant Rising Main Project

Each Technical and Price Proposal, must be received by the Contract Administrator in separate sealed envelopes prior to the time set for the Proposal Due Date/Time. The Proposals shall be so marked as to clearly indicate its contents without requiring it to be opened. If submitted by mail, this sealed envelope shall be enclosed in another envelope addressed to the Procurement Office, 1200 Penn Ave., 2nd Floor, Pittsburgh, PA 15222. The Proposal must be delivered to the exact location designated.

Offerors may be asked to substantiate Proposal representations made in any inquiry, as well as provide supplemental information or additional information about the scope of work outlined in their Proposals.

The second envelope shall include the Price Proposal for the services to be rendered. The sealed envelope must be clearly marked as follows:

Part II: Price Proposal
Request for Proposals for
PWSA Project No. PWSA104 for the
Lanpher Redundant Rising Main Project

Prices quoted in the Proposal shall be firm for the duration of this Contract.

Submission of a Proposal indicates acceptance of the conditions in this RFP. Exceptions and assumptions shall be noted and are negotiable. PWSA reserves the right to reject any

or all Proposals, waive technicalities, and to be the sole judge of the suitability of the proposed services for its intended use and further specifically reserves the right to make the award of this Contract in the best interest of PWSA.

Provisions of this RFP and the contents of the successful Proposals are considered available for inclusion in final contractual obligations.

B. PROPOSAL EVALUATION: Offeror's shall submit detailed information describing the following, to be used by the Selection Committee for proposal evaluation:

1. Letter of Transmittal: Include the name of the project "Request for Proposals for PWSA Project No. PWSA104 for Lanpher Redundant Rising Main Project," Offeror's name, and date of submittal. The letter shall be signed by a duly authorized representative of the Offeror submitting the Proposal. The letter must include the number of years in business.

2. Approach and Methodology (Max 20 Points): Describe proposed project management approach for each element of executing the project scope, including your understanding of the project, key milestones, and any other relevant information concerning your firm's qualifications for the project. Highlight alternative solutions, innovations, new technologies, or potential cost savings.

3. Proposed Project Timeline (Max 10 Points): Propose a project timeline depicting the timing of all work streams starting from the Notice to Proceed, including payment milestones. Major tasks and subtasks should be broken out. Time is of the essence. For purposes of this proposal, Offerors shall utilize a (tentative) Notice to Proceed date of January 1, 2019. Include a project schedule for each key focus area of the project, as identified in the Scope of Work. This schedule should contain key project milestones and timelines for deliverables. Identify assumptions used in developing the schedule.

4. Offeror's Experience (Max 20 Points): Submit a list of all similar contracts (in scope, water main design, easements, municipality coordination, etc.) that have been performed in the past five years, ending with the due date of this proposal. The list shall contain a description of the project; the Offeror's responsibilities; and client contact information including contact names, phone numbers, and e-mail addresses. Clearly indicate all utility and governmental authority references.

5. Key Personnel (Max 30 Points): Indicate the names, titles, and responsibilities of each proposed key personnel, including Project Manager. Submit full resumes of all proposed key personnel, including the Project Manager and staff of sub-Consultants (if any). Resumes shall indicate education and years of related experience and highlight roles and responsibilities related to similar projects (in scope, water main design, easements, municipality coordination, etc.), specialized skills, and specific licenses.

   Submit an organizational chart illustrating the project team and any sub-Consultants. Each individual is to be listed with area of expertise, percent allocated to this project

(e.g. 100%), and office location. PWSA will not refuse a Proposal based upon the use of sub-Consultants; however, PWSA retains the right to refuse the sub-Consultants selected.

6. Equal Opportunity Policy (EOP)-Participation Plan (Max 5 Points): Firms shall indicate their Minority/Woman/Veteran Business Enterprise/Service Disabled Veteran Business Enterprise (M/W/VBE/SDVBE) status and list M/W/VBE/SDVBE firms which the firm has established business relationships and intends to utilize. PWSA's current EOP goals of the total dollar value of Authority contracts include: MBE-18%, WBE-7%, VBE-5% and SDVBE-5%.

7. Location of Firm (Max 5 Points): Firms with an office located in Pittsburgh are given preference

8. Price (Max 10 Points): Price proposals will be evaluated for reasonableness. The project cost should be based upon the Scope of Work described in this solicitation, broken down by task.

14. SHORTLISTING OF OFFERORS: PWSA reserves the right to shortlist any number of qualified Offerors for presentations, demonstrations, and/or final selection. The Selection Committee will notify the shortlisted Offerors via e-mail and/or phone in advance to allow time to arrange travel.

15. PRESENTATIONS: *Shortlisted Offerors may be invited to provide a brief in-person* presentation or webinar. The shortlisted Offerors will be asked to make formal presentation of their Proposals and respond to questions from the Selection Committee. All costs incurred by the Offeror during the presentation shall be the responsibility of the Offeror. Following the presentations or webinars, the Selection Committee will make the final selection.

16. NEGOTIATIONS: At the request of PWSA, the Offeror may be required to meet to review the scope of services. The meeting may include review and discussion of:

A. Examples of similar work;
B. Standards, specifications, manuals, and other practices to be used;
C. Policies used by the Authority for the type of work involved;
D. A contract in draft form;
E. Methods of payment;
F. Procedures for invoicing;
G. Standard forms to be used;
H. Fiscal requirements; and
I. Items and/or services to be provided by PWSA.

Where appropriate, the Offeror will prepare a revised cost proposal for performing the required services. The Offeror's original or revised cost proposal shall be supported by a breakdown of the estimated workdays required to perform each of the services contained in the scope of work and the salary range for each of the classifications of personnel to be utilized. The Offeror's

original or revised cost proposal must include supporting documentation for payroll additives, direct costs, indirect costs, fixed fee, and overhead. The Designated Chairperson may request further discussion and negotiation to determine the reasonableness of the firm's cost proposal.

17. **PWSA'S RESPONSIBILITIES:** It is PWSA's responsibility to:

A. Ensure appropriate PWSA representation to perform assigned activities, attend meetings, and answer questions;

B. Ensure that decisions are made in a timely manner;

C. Designate a Project Manager; and

D. Provide access to the following documents:

1) Available historic water and sewer record drawings.

2) GIS layers for water mains, valves, hydrants, combined sewers, storm sewers, manholes, inlets, and catch basins.

3) PWSA water, sewer, and GI master bid item excel document containing standard unit bid items, measurement, and item descriptions.

4) PWSA guideline specification sections.

5) PWSA standard CAD drawing border.

6) PWSA standard community meeting PowerPoint template.

7) Previous reports and studies compiled.

8) Previous closed-circuit television inspection reports and dye test results.

18. **KEY PERSONNEL:** Detailed resumes of COSULTANT personnel must be submitted to PWSA for review and approval prior to assignment to any tasks. PWSA and COSULTANT will have the responsibility of determining the quality and quantity of work performed by the CONSULTANT's personnel. If, at any time, the level of performance is below expectations, the PWSA shall have the right to request removal of any project personnel. PWSA may request another person be assigned as needed.

19. **WORKING HOURS**: Normal working hours are Monday-Friday, 8:00 a.m. - 5:00 p.m., excluding weekends and PWSA observed holidays. It may be required that certain CONSULTANT personnel work other than normal working hours. Offerors should outline all compensation scenarios and assumptions in the Price Proposal.

20. **BASIS OF AWARD:** This Contract will be awarded to the highest ranked Offeror(s), based on the evaluation criteria defined in Section 13.B above.

21. **AGREEMENT:** The final executed Contract will be mutually agreed upon by PWSA and the CONSULTANT. PWSA reserves the right to renegotiate services deemed necessary to meet the needs of the program according to PWSA's priorities and goals. Renegotiated services outside the scope of the original contract shall require contract amendment prior to commencement of work.

22. **NOTICE OF AWARD:** The successful Offeror(s) will be notified by letter, giving Notice of Award, of PWSA's acceptance of their Proposal.

23. **INSURANCE REQUIREMENTS:** The successful Offeror(s) will be required to submit to PWSA, by the date indicated in the Notice of Award, a certificate of insurance duly executed to by the officers or authorized representatives of a responsible and non-assessable insurance company authorized to do business in Pennsylvania, evidencing that his/her firm has obtained the coverage herein required. The certificate of insurance must identify the types of insurance, the party to be benefited, the effective dates of the insurance, the limits of liability for both bodily injury, including death, and property damage, a paragraph pertaining to collapse and explosive hazards, a clause requiring 30 days advance written notice to PWSA of cancellation, and a specific reference to the location and nature of the Work. Failure to submit the required certificate of insurance may be cause to rescind the award. The required insurance shall be as follows:

A. GENERAL LIABILITY INSURANCE

Minimum Limits of Liability

1) Bodily Injury, Including Death
   (a) $1,000,000.00 each occurrence
   (b) $2,000,000.00 aggregate
2) Property Damage
   (a) $50,000.00 each occurrence
   (b) $100,000.00 aggregate

PWSA MUST BE IDENTIFIED ON THE INSURANCE CERTIFICATE AS ADDITIONAL INSURED AS TO THIS COVERAGE. In those instances where bodily injury and property damage coverage are combined in a single limit of liability, said limit must be in an amount not less than $2,000,000.00 aggregate. The certificate must indicate "OCCURRENCE" policy, a "Claims made" policy is not acceptable.

B. AUTOMOBILE LIABILITY INSURANCE

1) Bodily Injury, Including Death

(a) $1,000,000.00 each occurrence

(b) $2,000,000.00 aggregate

2) Property Damage

(a) $50,000.00 each occurrence

(b) $500,000.00 aggregate

PWSA MUST BE IDENTIFIED ON THE INSURANCE CERTIFICATE AS ADDITIONAL INSURED AS TO THIS COVERAGE. In those instances where bodily injury and property damage coverage are combined in a single limit of liability, said limit must be in amount not less than $1,000,000.00 aggregate. The certificate must indicate "OCCURRENCE" policy, a "Claims made" policy is not acceptable.

C. WORKER'S COMPENSATION INSURANCE. The CONSULTANT hereby certifies that it has accepted the provisions of the Workers' Compensation and Occupational Disease Acts, as amended and supplemented, insofar as the Work covered by this Contract is concerned, and that it has insured its liability thereunder in accordance with the terms of said Acts, as evidenced by the certificate of insurance it has provided to PWSA.

D. PROFESSIONAL LIABILITY: $1,000,000 each occurrence.

24. CONDITIONS OF AWARD: The performance of this Contract shall be governed solely by the terms and conditions as set forth in the executed Contract.

25. NOTICE TO PROCEED: Upon execution of the Agreement by PWSA and the CONSULTANT, PWSA shall issue Notice to Proceed to the CONSULTANT. The successful Offeror shall not begin any work on this Contract until such time as a Notice to Proceed has been issued by PWSA.

26. DISSEMINATION OF INFORMATION: The CONSULTANT shall:

A. NOT release any information related to the services or performance of the services under this Contract, nor publish any reports or documents related to this Contract without the prior written consent of PWSA; and

B. Hold all materials and information belonging to PWSA or PWSA's agents in strictest confidence and not to make use thereof other than for the performance of contractual obligations, to release it to or disclose it to any other party.

Any information of a restricted nature provided to the CONSULTANT by the PWSA Project Manager or his/her designee in the course of contract implementation shall be

handled in accordance with restrictions placed thereon by the Project Manager. Information or documents given to or generated by the CONSULTANT in the course of contract implementation shall be considered restricted information and subject to handling and dissemination restrictions as specified herein and/or as specified by the Project Manager.

27. **CONFIDENTIALITY**: The CONSULTANT will not, either during or after performance of the Services, except as required in the performance of the Services or with the prior written consent of PWSA, communicate or divulge to, or use for the benefit of the CONSULTANT or any other person, firm, association, or corporation, any confidential or proprietary information of PWSA, including but not limited to the Project deliverables and other data reviewed or developed during the performance of the Services."

28. **INDEMNIFICATION**: The CONSULTANT agrees to completely indemnify, save and hold harmless and defend PWSA, its officers, directors, board members, employees, agents, Design Professionals and Consultants from any and all liens, charges, claims, penalties, demands, losses, judgments, penalties, liabilities, damages, and defense costs including, but not limited to, legal fees and courts costs, causes of action or suits of any kind or nature whatsoever, in law or in equity, judgments, liabilities and damages of any and every kind and nature whatsoever, from any causes whatsoever, whether known or unknown, foreseen or unforeseen, intentional or negligent, arising by reason of or during the performance of any Work of any kind or nature covered by this Contract.

    The CONSULTANT shall completely indemnify and save harmless PWSA against and from any and all claims, demands, actions, and/or causes of action growing out of any alleged, claimed and/or actual personal injuries or death incurred by any person, including the CONSULTANT, its employees, agents and/or Consultants or property damage suffered by any person, including the CONSULTANT and its employees, whether the same results from the actual or alleged negligence of PWSA or the PWSA's agents and/or employees or otherwise, it being the intent of this provision to absolve and protect PWSA from any and all loss by reason of the premises or anything related in any way whatsoever to the Work and/or the Contract. The CONSULTANT shall supply written evidence of insurance satisfactory to PWSA covering the liabilities and indemnification required by this Contract.

    In the event that the CONSULTANT brings and/or files a lawsuit against PWSA and does not recover the entire amount sought and/or alleged in its claim or lawsuit against PWSA, the CONSULTANT shall compensate PWSA for all attorneys' fees and all other costs incurred by PWSA to defend itself against each of the CONSULTANT's claims or lawsuits.

29. **OWNERSHIP RIGHTS:** PWSA shall own all data, reports, etc. produced as a result of work performed under this Contract.

30. **PAYMENT:** The CONSULTANT shall submit invoices to the PWSA Project Manager via eBuilder on a monthly basis. The Project Manager will provide the CONSULTANT with the format and information required to be included in the invoice. Invoices shall be submitted no later than the 15th of the month for work completed the preceding month. PWSA shall have final decision on all questions which may arise as to the quality or acceptability of deliverables furnished and work performed by the Consultant.

31. **DEBRIEFING OF UNSUCCESSFUL OFFERORS:** Upon written request made within 30 calendar days after Contract Award, the Procurement Office shall provide any unsuccessful Offeror with a discussion of PWSA's evaluation of his/her proposal, citing the deficiencies and weaknesses. Point-by-point comparisons with the proposals of others will not be made. Debriefings will not include discussions of information contained in other Offerors' proposals.

32. **NO CONTRACT WILL BE AWARDED TO PERSONS IN ARREARS TO PWSA:** The Contract will not be awarded to any corporation, firm or individual who is, from any cause, in arrears to PWSA.

33. **AFFIDAVIT UNDER PITTSBURGH CODE §161.22 (f):** The CONSULTANT will also be required to submit an executed Affidavit of Consultant as required by Pittsburgh Code §161.22(f) which will state, under penalty of perjury, that neither they nor their company, corporation, partnership, or any affiliated individual is prohibited from entering a bid or participating in a City of Pittsburgh or a PWSA contract by reason of debarment or disqualification as defined by Pittsburgh Code §161.22(b).

34. **EXCLUDE SALES TAX:** In computing Proposals, the CONSULTANT shall not include amounts for Pennsylvania Sales or Use Tax on materials and equipment to be incorporated in facilities used directly in rendering public utility service pursuant to 61 PA Code § 31.11 – 31.16. The CONSULTANT shall ascertain in advance whether such exemption is available, and the CONSULTANT shall, in compliance with such regulation, furnish the supplier with an exemption certificate properly endorsed by PWSA.

    The CONSULTANT shall supply PWSA with a statement that Pennsylvania Sales or Use Tax on materials and equipment to be incorporated in facilities used directly in rendering public utility service has not been included in the computation of the proposal.

35. **STATEMENT OF AFFILIATION:** Successful Offerors must provide PWSA with a statement of affiliation. The statement of affiliation shall include:

    A. a description of the CONSULTANT's qualifications and experience qualifications;

    B. a description of any contractual or business relationship with the City of Pittsburgh or PWSA within the past three years; and

    C. an identification of the CONSULTANT's principals, owners, partners or shareholders, or if the CONSULTANT is a public corporation, the officers, members of the board of directors and shareholders holding more than three percent of the corporate stock.

36. **AFFIRMATIVE ACTION:** Offerors are invited to consult with the Contract Administrator, for information, advice and assistance in the preparation of their Proposals pertaining to affirmative action.

37. **ANTI-DISCRIMINATION:** The CONSULTANT shall not discriminate in its employment on the basis of race, color, religion, ancestry, national origin, place of birth, sex, age, disability, non-job-related handicap or sexual orientation. The CONSULTANT shall comply

with the applicable provisions of the Pittsburgh Code, Title Six - Conduct, Article V - Discrimination, and any amendments thereto. The CONSULTANT shall also comply with the applicable provisions of Title I and Title II of the Americans with Disabilities Act, any amendments thereto and any regulations issued thereunder. The CONSULTANT shall incorporate in any Subcontracts which may be permitted under the terms of this Contract a requirement that said SubConsultants must also strictly comply with the provisions of this Article of the Contract.

38. **NON-DISCRIMINATORY PRACTICES AND POLICIES**: Prior to the award, the Contract Administrator may direct that any Offeror submit a statement signed by an authorized officer or agent of any labor union or any agency referring workers or providing or supervising apprenticeship or other training, with which the Offeror deals, with supporting information to the effect that the signer's practices and policies do not discriminate on the grounds of race, sex, color, religion, ancestry, national origin or place of birth. In this statement the signer either will agree to cooperate affirmatively in the implementation of the policy and provisions of the Contract and the MBE/WBE Solicitation and Commitment Statement or will agree that recruitment, employment, and the terms and conditions of employment under the Contract shall be in accordance with the purposes and provisions of the Contract. In the event that the union, or agency, shall refuse to execute such a statement, the Offeror shall so certify and set forth what efforts have been made to secure such a statement and such additional factual material as the Contract Administrator may require.

39. **SETTLEMENT OF DISPUTES**: In the event of any disagreement, controversy, or dispute arising between the CONSULTANT and PWSA as to the interpretation or proper execution of the Contract or as to the settlement thereunder or in the event of any disagreement as to any question or matter whatsoever which may arise or be in dispute under the Contract or of the terms or conditions thereof, such disagreements, controversy or dispute shall be immediately inquired into and decided by PWSA whose decision shall be final, binding and conclusive as to all matters in controversy, without exception or appeal, and all rights or right of action at law or in equity or otherwise under and by virtue of this Contract are expressly waived.

40. **DISPUTES OR CONTROVERSIES:** Should any dispute or controversy whatsoever arise between the CONSULTANT and PWSA with respect to the Contract concerning any Work performed by the CONSULTANT pursuant to the Contract, then the CONSULTANT shall give 30 days certified written notice to PWSA of the CONSULTANT's intent to resort to legal action. If the CONSULTANT chooses to pursue legal action against PWSA, it must commence such legal action within one year of the accrual of any such alleged claim.

41. **TERMINATION:** If the CONSULTANT is adjudged a bankrupt or if it makes a general assignment for the benefit of creditors or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails, except in cases for which an extension of time is provided, to supply enough properly skilled workers or proper materials or if it persistently disregards laws, ordinances, rules, regulations or order of any public authority having jurisdiction, or otherwise has committed a violation of the provision of the Contract Documents, including, but not limited to, the failure to timely pay its SubConsultants and/or material suppliers, the Director may, without prejudice to any right or remedy of PWSA and after giving the Contract and/or the CONSULTANT's surety, if any, seven days written notice

of PWSA's intent to terminate the Contract and take possession of the site and all materials, equipment, tools, and machinery thereon owned by the CONSULTANT, and may furnish the Work by whatever method that PWSA may deem to be expedient.

The CONSULTANT shall have seven (7) days to cure each and every breach that PWSA determines that the CONSULTANT has committed. If the CONSULTANT fails to fully remedy each such breach to the complete satisfaction of the Director, the Contract shall be terminated immediately. The CONSULTANT shall not be entitled to receive any further payment from PWSA until the Work is finished. If the unpaid balance of the Contract exceeds the cost of finishing the Work, including compensation for any additional costs including, but not limited to, any indirect costs incurred by PWSA, such excess shall be paid to the CONSULTANT. If such costs exceed the unpaid balance, the CONSULTANT and/or the CONSULTANT's surety shall pay the difference to PWSA within 30 days of the date of billing by PWSA. Furthermore, recovery by the CONSULTANT of any alleged anticipated lost profits from PWSA is explicitly prohibited. Additionally, PWSA may, at any time, terminate or suspend the Contract for PWSA's convenience and without cause.

Upon the CONSULTANT's receipt of written notice from PWSA of a termination or suspension for PWSA's convenience, the CONSULTANT shall cease operations as directed by PWSA and shall take all actions that are necessary or which PWSA deems to be necessary for the preservations and protection of the Work. PWSA may terminate or suspend the Contract for convenience, without cause, by providing 30 days written notice of the same to the CONSULTANT. The CONSULTANT shall not be entitled to any compensation for any costs, damages or losses of profits allegedly caused by PWSA's termination for convenience.

42. **COMPLIANCE WITH ALL LAWS:** The CONSULTANT and all their personnel shall fully obey and comply with all federal, state, and local laws, ordinances and administrative regulations, and orders made in accordance therewith and obtain all permits which are or shall become applicable to the Work performed pursuant to this Agreement. All services required hereunder shall be performed in accordance with the latest regulations, policies, procedures, manuals, and standards of applicable regulations, policies, procedures, manuals, and standards of the PWSA or governing organizations.

43. **GOVERNING LAW:** This Contract shall be governed by and construed and enforced in accordance with the laws of the Commonwealth of Pennsylvania.

44. **AUDIT:** PWSA may inspect and copy the CONSULTANT's records that are related in any way to the Project at any time up to three years after the day final payment is made. The CONSULTANT shall check all materials, equipment and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under the Contract, and the system shall be satisfactory to PWSA. PWSA or its representative shall be afforded access and allowed to audit all the CONSULTANT's records, books, correspondence, instructions, drawings, estimate sheets, bids, purchase orders, back charges, receipts, vouchers, canceled checks, memorandum and similar data relating to this Contract, and the CONSULTANT shall preserve all such records for a period of three years, or for such longer period as may be required by law, after the final payment. All Subcontracts awarded shall be subject to this provision and other provisions of this

Agreement insofar as applicable. This provision shall have full force and effect regardless of any disputes which may arise at any time in the course of the Project.

45. **INDEPENDENT CONSULTANT:** The CONSULTANT is and will remain at all times an independent CONSULTANT, and no provision of this Contract is intended to create any relationship of employment, joint venture, partnership, or agency between the CONSULTANT and PWSA. The CONSULTANT will have no authority to bind PWSA in any respect or otherwise execute any documents on behalf of PWSA pursuant to this Contract. The CONSULTANT shall not be eligible to participate in any benefit plans, programs or arrangements made available to employees of PWSA.

46. **SUBCONTRACTING AND ASSIGNMENT:** The CONSULTANT shall not subcontract any of the services without the prior written approval of PWSA. Such approval or consent will not relieve CONSULTANT of its contractual obligations. PWSA reserves the right to object and require the replacement of any subcontractor who is hired or retained without PWSA's prior written consent. The CONSULTANT shall not assign the Contract or any right to monies to be paid hereunder without the prior written consent of PWSA.

ATTACHMENT SECTION

Figure 1 – Recommended Route Lanpher Rising Main
Figure 2 – Recommended Route Lanpher Rising Main
Figure 3 – Recommended Route Lanpher Rising Main
Figure 4 – Recommended Route Lanpher Rising Main
Lanpher Rising Main Feasibility Report, October 2016, Mott MacDonald, LLC

Exh. RAW/C-16



05/18/18

FIGURE – 1

RECOMMENDED ROUTE

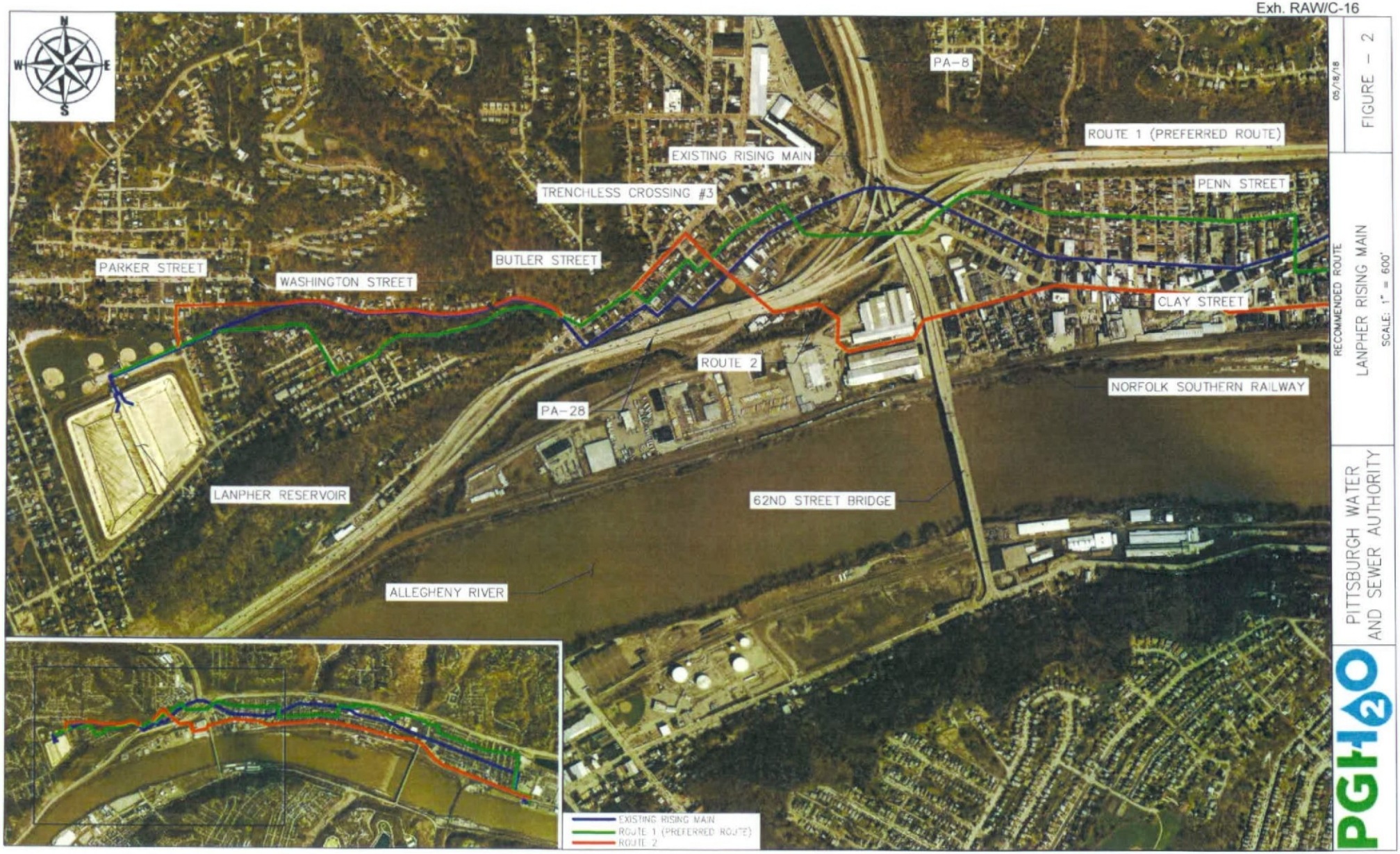
LANPHER RISING MAIN

SCALE: 1" = 600'

PITTSBURGH WATER AND SEWER AUTHORITY

PGH2O

Exh. RAW/C-16



05/18/18

FIGURE – 2

RECOMMENDED ROUTE

LANPHER RISING MAIN

SCALE: 1" = 600'

PITTSBURGH WATER AND SEWER AUTHORITY

PGH2O

Exh. RAW/C-16



Legend:
- EXISTING RISING MAIN
- ROUTE 1 (PREFERRED ROUTE)
- ROUTE 2
- VALVE CLOSED
- VALVE OPEN

PITTSBURGH WATER AND SEWER AUTHORITY

PGH2O

RECOMMENDED ROUTE

LANPHER RISING MAIN

SCALE: 1" = 100'

05/23/18

FIGURE – 3

Exh. RAW/C-16



Legend:
- EXISTING RISING MAIN
- ROUTE 1 (PREFERRED ROUTE)
- ROUTE 2
- VALVE CLOSED
- VALVE OPEN

PITTSBURGH WATER AND SEWER AUTHORITY

PGH2O

RECOMMENDED ROUTE

LANPHER RISING MAIN

SCALE: 1" = 100'

05/23/18

FIGURE – 4

Exh. RAW/C-16

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PGH2O
Pittsburgh
Water & Sewer
Authority

Lanpher Rising Main Feasibility Report

October 2016

Pittsburgh Water and Sewer Authority
359110

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Mott MacDonald, LLC
Gateway View Plaza
1600 West Carson Street
Pittsburgh, PA 15219

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Pittsburgh, PA 15222

Lanpher Rising Main Feasibility Report

October 2016

Pittsburgh Water and Sewer Authority
359110

Issue and revision record

Revision	Date	Originator	Checkout	Approver	Descriptor

Information class: Standard

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1 Introduction

The Lanpher Rising Main is a 60-inch diameter 20,000-foot long riveted steel pipeline that was constructed in the 1920's. The Lanpher Rising Main is owned and operated by the Pittsburgh Water and Sewer Authority (PWSA) and functions as the sole conduit for conveying treated potable water from the PWSA Drinking Water Plant in Aspinwall Borough through Aspinwall, Sharpsburg, and Etna Boroughs and Shaler Township to the Lanpher Reservoir. Water is pumped through the rising main by the Aspinwall Pump Station which is located at the PWSA Drinking Water Plant in Aspinwall Borough. In consideration of the rising main's age and the lack of a redundant water source for the service area and reservoir, PWSA desires to investigate the feasibility of constructing a redundant rising main.

1.1 Objective

The primary objective in the construction of a new rising main is to provide redundancy to the existing rising main system.

The redundant rising main would provide the same level of service as the existing rising main by providing treated drinking water to the Lanpher Reservoir and to the existing service connections. The redundant main could be operated by PWSA in parallel with the existing rising main, or it could be placed in service as the main conduit with the existing rising main utilized as a backup system. Existing service connections would be connected to the new rising main. Potential new service connections could be installed at strategic locations on the new rising main to serve additional customers.

A secondary objective in the construction of a new rising main will be to serve as part of a future rehabilitation effort of the potable water clearwell at the PWSA Drinking Water Plant in Aspinwall. This clearwell rehabilitation effort may require a temporary location where chlorine contact time (CT) is achieved while the clearwell is out of service. One approach to achieving this is to utilize the Lanpher Reservoir for this purpose. Under this scenario, the new rising main would convey water to Lanpher. Following the required CT in the reservoir, disinfected potable water would exit Lanpher Reservoir and return through the existing rising main to each of the service connections and Fox Chapel Pumping Station.

PWSA has contracted with Mott MacDonald to perform an evaluation of alternative methods to achieve these objectives.

1.2 Purpose

The purpose of this Feasibility Study is to determine the feasibility of constructing a new rising main system to meet the primary objective of providing redundancy to the existing Lanpher Rising Main System. The feasibility of meeting the primary objective will be determined by evaluating a number of factors that are itemized in Section 3 of this report. The primary drivers in the evaluation are:

- Constructability
- Redundancy and hydraulics
- Construction cost

- Complexity and risk of trenchless crossings
- Impacts to residents and business

2 Existing Lanpher Rising Main System

2.1 Physical description

The existing Lanpher Rising Main extends through the boroughs of Aspinwall, Sharpsburg, and Etna, and Shaler Township as shown on Figure 1. The existing route traverses railroad systems, PennDOT highways, water bodies, and utilities and is primarily routed within existing public right-of-ways and beneath paved roadways and alleys. However, there are several locations where the route traverses through business parking areas, private property, creeks, and wooded areas.

Figure 2 shows the ground surface profile of the existing Lanpher Rising Main. The profile initiates at an invert elevation of 748 feet at the Aspinwall Pump Station and terminates at an elevation of 934 feet at the Lanpher Reservoir inlet structure. The profile has a slight negative slope for its initial 16,500 feet before intersecting Butler Street in Etna Borough and then ascends along Parker Street to the Lanpher Reservoir. The lowest elevation along the route is at Pine Creek, located near the intersection of PennDOT 8 and 28, at an elevation of about 720 feet.

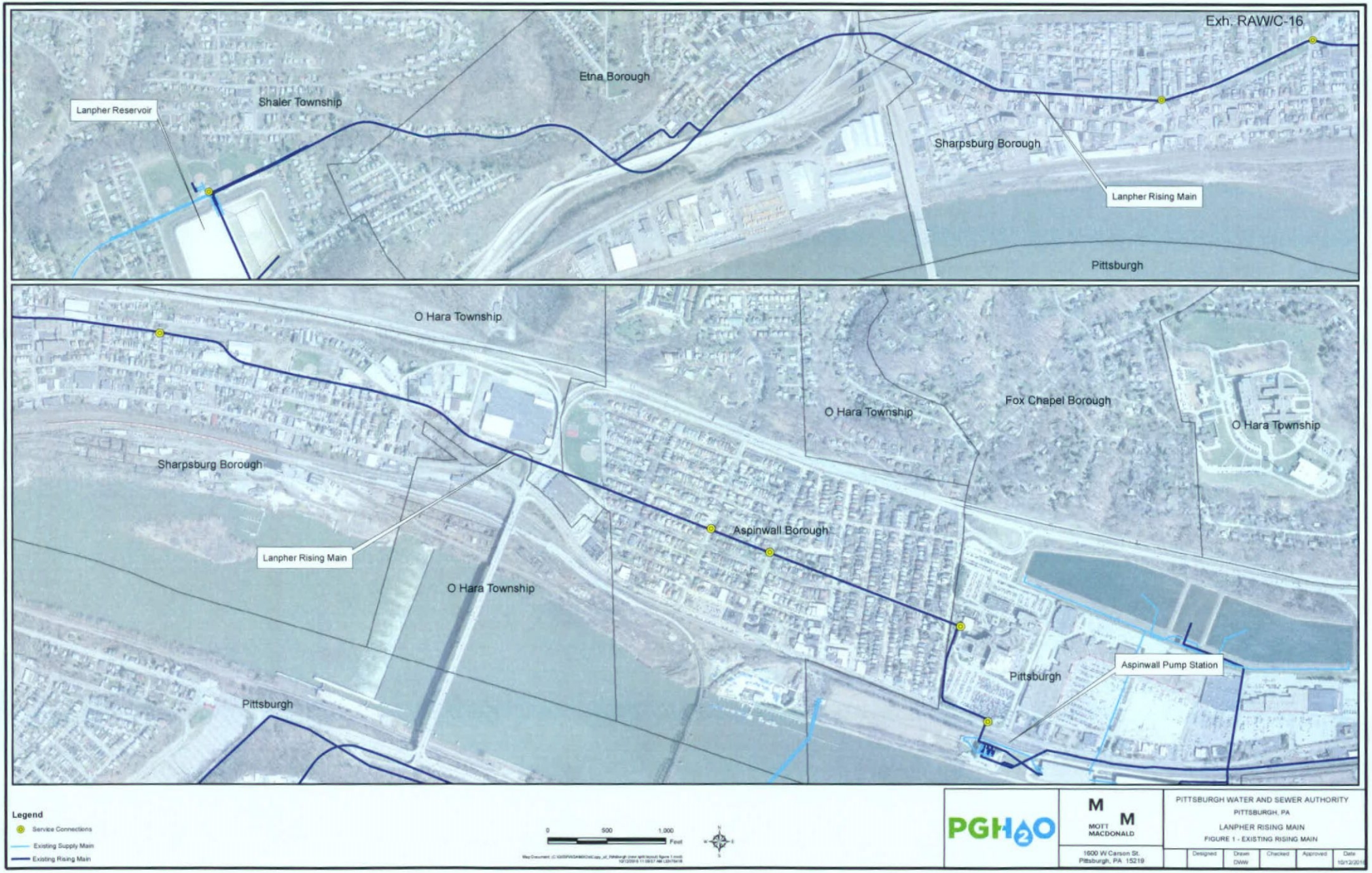
The rising main receives pumped potable water from the Aspinwall Pump Station which is located at the PWSA Drinking Water Plant in Aspinwall Borough. The pump station consists of four (4) pumps. Table 1 provides pump information for the Aspinwall Pump Station.

Table 1: Aspinwall pump station pumps

Pump No.	Aspinwall Pumps			
	1	2	3	4
Capacity (MGD)	12	15	22	28
TDH (feet)	265	265	265	265
Motor (HP)	1,000	1,000	1,500	1,500

The four (4) pumps share two (2) common pump discharge pipes with Pumps 1 and 3 and Pumps 2 and 4 pumping through common 36-inch diameter discharge outlets to a common 60-inch diameter manifold. The 60-inch diameter manifold extends from the plant site to the west as the Lanpher Rising Main. The 60-inch diameter manifold also extends to the east through an isolation valve and a reducer to a 24-inch diameter pipe. The 24-inch diameter pipe serves the drinking water plant filter building as an emergency filter backwash supply main.

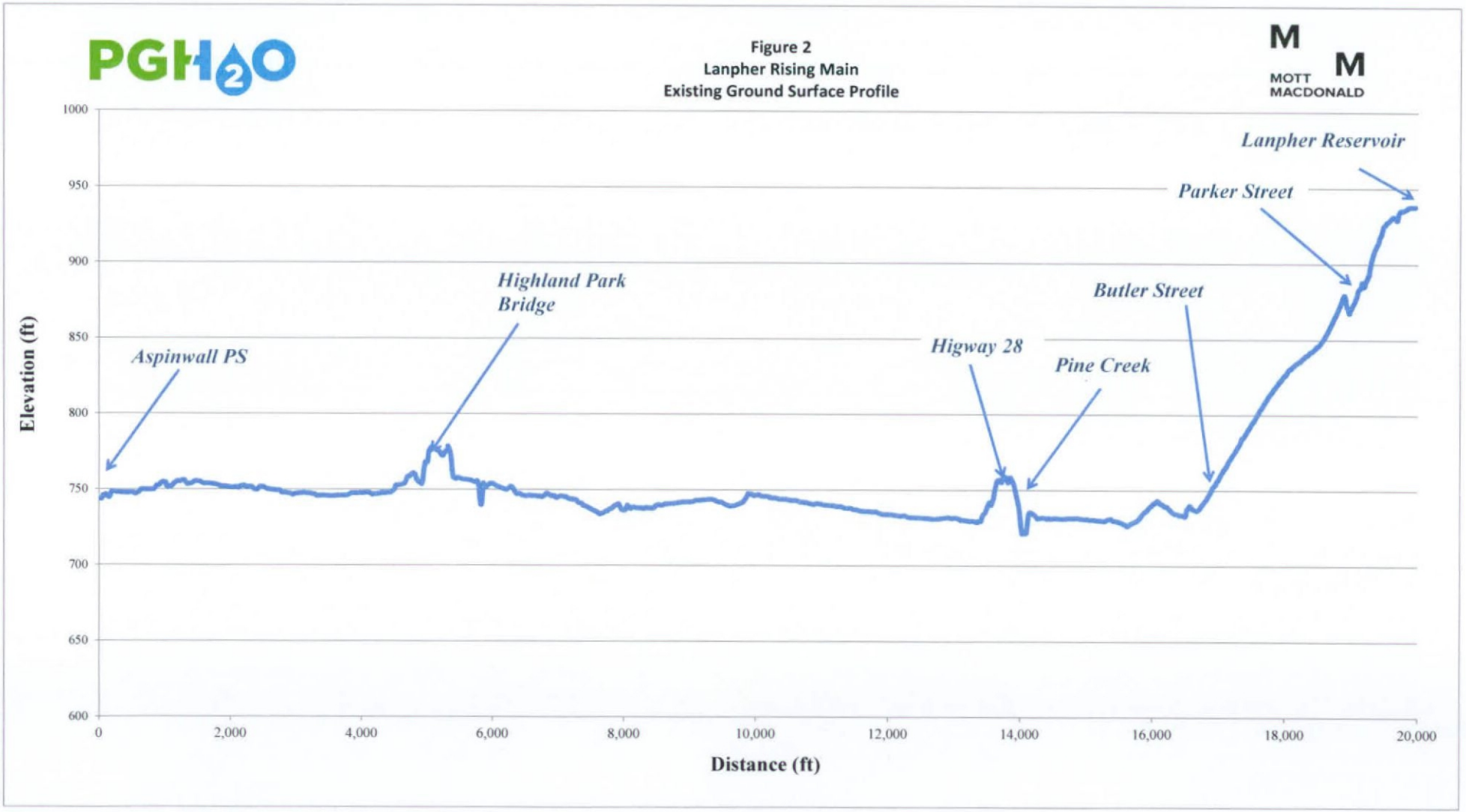
The Lanpher Rising Main is connected to the Lanpher Reservoir at the reservoir's inlet gate house at an elevation of 934 feet. The reservoir operates at a low elevation of 958 feet and a high water level of 972 feet. The rising main extends to the reservoir inlet gate house through a network of pipes and isolation valves designed to allow the reservoir to route potable water from the reservoir to the service areas on the City of Pittsburgh's north side.


Exh. RAW/C-16
Lanpher Reservoir
Shaler Township
Etna Borough
Sharpsburg Borough
Lanpher Rising Main
Pittsburgh
O Hara Township
Fox Chapel Borough
O Hara Township
O Hara Township
Sharpsburg Borough
Aspinwall Borough
Lanpher Rising Main
O Hara Township
Pittsburgh
Pittsburgh
Aspinwall Pump Station
Legend
Service Connections
Existing Supply Main
Existing Rising Main
0
500
1,000
Feet
PGH2O
MOTT MACDONALD
1600 W Carson St.
Pittsburgh, PA 15219
PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 1 - EXISTING RISING MAIN
Designed
Drawn
DWW
Checked
Approved
Date
10/12/2016

PGH2O

Figure 2
Lanpher Rising Main
Existing Ground Surface Profile

MOTT MACDONALD



PGH2O

Table 2
Lanpher Rising Main Service Connections

MOTT MACDONALD

Station	Location	Tap Size (in)	Service Area	Average Daily Demand (gal)	Average Flow Rate (gpm)	Min Monthly (gal)	Avg Monthly (gal)	Max Monthly (gal)
---	Freeport Rd	30	Waterworks Mall/ Blawnox	54,600	38	1,195,161	1,639,102	2,102,913
144+57	Delafield Rd	24	Hospital	98,800	69	664,028	2,964,208	5,669,601
161+43	Eastern Ave	16	Aspinwall	182,700	127	3,102,273	5,480,781	9,277,500
167+13	Center Ave	8	Aspinwall	2,900	2	7,000	85,760	320,690
217+50	18th St	16	Sharpsburg	22,100	15	0	663,157	6,990,000
232+01	15th St	6	Sharpsburg	Emergency Connection				
244+94	11th St	6	Sharpsburg	Emergency Connection				
274+62	Bridge St	16	Etna	Capped				
---	Lanpher Reservoir	8	Shaler	17,400	12	349,071	522,614	1,050,805
---	Aspinwall Pump Station	16	Fox Chapel	1,888,700	1312	38,862,750	56,660,193	146,922,000
			TOTALS:	**2,267,200**	**1,574**	**44,180,284**	**68,015,816**	**172,333,508**

As shown on the previously presented Figure 1, eight (8) service connections intersect the rising main along its route. Metered water demand data at each of the service connections is provided in Table 2. Two (2) of the service connections are utilized as emergency connections and a third is capped. The remaining five (5) service connections provide potable water to Aspinwall Borough, Sharpsburg Borough, and St. Margret's Hospital.

2.2 Repair history and condition of existing Lanpher Rising Main System

The Lanpher Rising Main has been in operation for nearly 100 years. During this time it has served to convey drinking water to the Lanpher Reservoir and the service areas along its route. However, in order to maintain this functionality, PWSA has performed repairs that were intended to lengthen the lifetime of the rising main system. See Appendix A for historic information related to the repair work.

In 1930 PWSA had a portion of the Lanpher Rising Main encased in concrete. The work was performed under two (2) contracts.

- Contract No. 1 was performed at the Guyastuta Run Crossing in O'Hara Township.
- Contract No. 2 was performed at South Canal Street near the intersection of 18th Street in Sharpsburg Borough.

In the late 1960's through the mid 1970's, PWSA initiated a cleaning and cement mortar lining effort to the interior of much of the existing Rising Main route and to repair and replace isolation and blow off valves along the route.

- In 1967, PWSA performed the cleaning and cement lining effort from Eastern Avenue in Aspinwall Borough for a length of approximately 8,000 feet to the west culminating at the intersection of North Canal Street and 15th Street in Sharpsburg Borough. During this work, two (2) isolation gate valves were installed.
- In 1968, PWSA performed the cleaning and cement lining effort from Pine Creek in Etna Borough to the Lanpher Reservoir.
- In 1974, PWSA performed the cleaning and cement lining effort from the Aspinwall Pump Station to Eastern Avenue in Aspinwall Borough. During this work a new valve structure with isolation valves was installed at the intersection of Delafield and Second Ave in Aspinwall.

In 2015, PWSA had a portion of the Lanpher Rising Main improved by installing a carbon fiber liner to the interior of port of the rising main. The segment that was improved was in the vicinity of the Pine Creek Crossing beneath the PennDOT Highway 28 and 8 interchange between Sharpsburg and Etna Boroughs. The work required extensive cleaning and conditioning of the existing rising main walls. The cleaning and conditioning work involved removal of a low strength cement past from the pipe wall, moisture testing, and high strength grout injection to prevent infiltration at 21 locations along the segment.

3 New rising main system evaluation

As previously stated, the primary objective in considering the new rising main is to provide a redundant system to the existing Lanpher Rising Main System. The purpose of this evaluation is to determine the feasibility of constructing a new rising main system. The evaluation will focus on three (3) alternative routes for a new Rising Main. The three alternative routes were established at the Lanpher Rising Main Project Workshop Number 1 (Workshop No. 1). The three alternative routes will be evaluated using factors that were developed at Workshop No.1.

3.1 Evaluation criteria

As part of Workshop No. 1, PWSA and Mott MacDonald developed list of evaluation criteria were created to generate primary factors for evaluating the overall feasibility of new Rising Main alternative routes.

The list of evaluation criteria that was discussed at the Workshop No. 1 is as follows:

- Impact to public and business
- Traffic impact
- Adequate access for construction and maintenance
- Redundancy and hydraulics
- Feasible construction methods
- Permitting
- Complexity and risk of trenchless crossings
- Limited wetlands mitigation
- Construction cost
- Selecting alignment for potential future customers
- Potential for utility conflicts and required relocations
- Pipe material and potential for material corrosion
- Accessibility to pipe in future for maintenance
- Impacts to business and residents
- Regulatory review schedule
- Constructability
- Overall project schedule
- Number of easements
- Long-term reliability

Based upon the discussion at the Workshop, PWSA input and Mott MacDonald's previous experience on similar projects, the following issues have been identified as the primary factors for comparing alternate routes:

- Constructability
- Redundancy and hydraulics

- Construction cost
- Complexity and risk of trenchless crossings
- Impacts to business and residents

3.1.1 Constructability

The evaluation of constructability includes an assessment of the most feasible method of constructing the water main. Open cut and trenchless methods will be considered for the water main route. This will include the most feasible option for crossing locations where property owners will not permit open-cut construction or where permitting requirements make open-cut installation not feasible or practical (i.e. water body crossings or highway crossings). Pipe material will be evaluated to determine the suitability of certain materials for the proposed installation and system conditions.

3.1.2 Redundancy and hydraulics

PWSA's ability to provide drinking water service to the existing and potential service areas is a primary factor in constructing the redundant rising main system. The new rising main is to provide PWSA with operational flexibility, should be located in close proximity to the existing rising main, and is to provide a level of service that would allow PWSA to serve additional customers in the future if needed.

3.1.3 Construction cost

The estimated cost to construct the new rising main will be considered for the alternate routes in order to provide a quantitative evaluation of the routes.

3.1.4 Complexity and risk of trenchless crossings

The number of trenchless crossings and the complexity in achieving the crossings will be a critical component in comparing the alternative routes. As such, special consideration will be given to minimizing the number, complexity, and risk in crossing highways, water bodies, railroad property, and other locations where open-cut construction is not possible.

3.1.5 Impacts to residents/business

Much of the existing and proposed rising main routes extend through residential neighborhoods and through areas where small businesses exist. The impact to these neighborhoods during construction is a major consideration in PWSA's decision-making process. The necessity of limiting impacts in these areas will be considered for each of the alternative routes in order to provide a qualitative analysis.

3.2 Alternative routes

An important aspect of Workshop No. 1 was to identify three alternative routes for a new rising main. The three alternative routes that were selected at the kickoff meeting are presented in Figure 3. Each alternative route commences at the Aspinwall Pump Station at the PWSA Drinking Water Plant in Aspinwall Borough and terminates at the inlet structure at the Lanpher Reservoir in Shaler Township.

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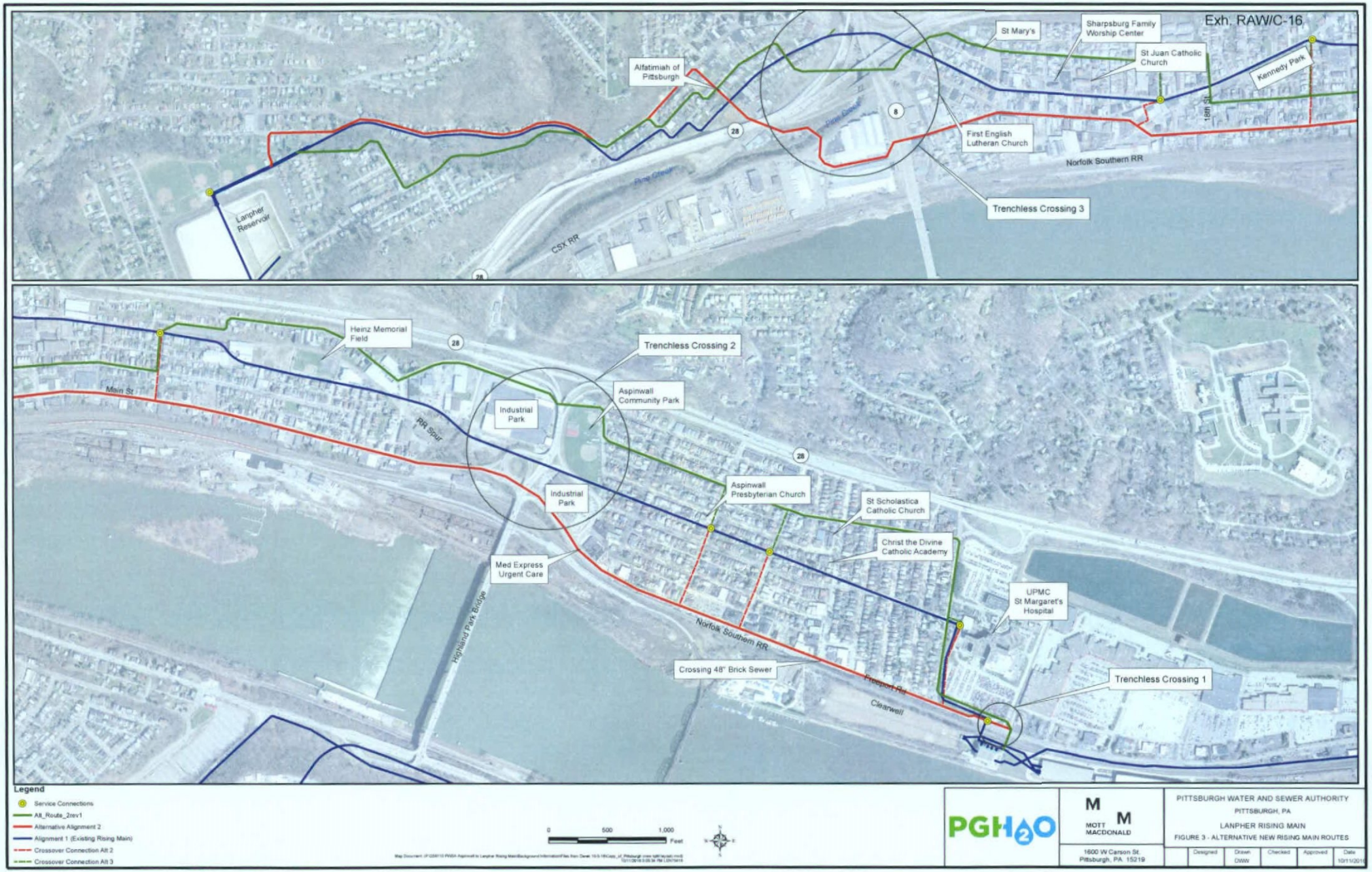

Legend

- Service Connections
- Alt_Route_2rev1
- Alternative Alignment 2
- Alignment 1 (Existing Rising Main)
- Crossover Connection Alt 2
- Crossover Connection Alt 3

0 500 1,000 Feet

PGH2O

MOTT MACDONALD
1600 W Carson St
Pittsburgh, PA 15219

PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 3 - ALTERNATIVE NEW RISING MAIN ROUTES

Designed	Drawn	Checked	Approved	Date
	DWW			10/11/201

3.2.1 Alternative Route No. 1

Alternative Route No. 1 follows the existing rising main route and initiates at the Aspinwall Pump Station in Aspinwall Borough and extends along Freeport Road, Delafield Street, 2nd Street, 2nd Street Alley, and into the Aspinwall Community Park. From the park, the route extends under the on-ramp to PennDOT Highland Park Bridge and into Sharpsburg Borough.

In Sharpsburg Borough, the route extends in a westerly direction from the PennDOT Highway crossing through an industrial park and along an unnamed gravel roadway to Chapman Street, through an industrial complex to South Canal Street, along North Canal Street and Clay Street, and under the PennDOT Highway 28 and 8 interchange to Etna Borough.

In Etna Borough and Shaler Township the route follows the existing rising main alignment along Sycamore Street, Cherry Street, through an industrial complex to the intersection of Butler Street and Parker Street, along Parker Street to Sherman Street, and into the Lanpher Reservoir property.

The total length of the proposed rising main shown as Alternative Route No. 1 is 19,772 feet. Alternative Route No. 1 would require three (3) trenchless crossings of property where open cut construction will not be achievable.

3.2.2 Alternative Route No. 2

Alternative Route No. 2 commences at the Aspinwall Pump Station in Aspinwall Borough and extends in a westerly direction along Freeport Road to the Highland Park Bridge. The route extends under the bridge and into Sharpsburg Borough to Main Street.

In Sharpsburg Borough the route extends in a westerly direction from the Highland Park Bridge along Main Street and South Main Street to PennDOT Highway 8 (William Flynn Highway). The route extends under Highway 8 and into Etna Borough.

In Etna Borough and Shaler Township, the route extends in a west-northwest direction from the Highway 8 crossing into an industrial park and to Poplar Street. From Poplar Street the route extends to the north crossing Pine Creek and PennDOT Highway 28 to a ballfield. From the ballfield, the route extends along VFW Way, Butler Street, and Parker Street to Koehler Street and into the Lanpher Reservoir property.

The total length of the proposed rising main shown as Alternative Route No. 2 is 19,651 feet. An additional length of 3,386 feet of pipe would be required to connect the proposed rising main with the existing system at each of the active service connections.

3.2.3 Alternative Route No. 3

Alternative Route No. 3 commences at the Aspinwall Pump Station in Aspinwall Borough and extends along Freeport Road, Delafield Street, 4th Street, Field Street, and into the Aspinwall Community Park. From the park, the route extends under the PennDOT Highland Park Bridge on-ramp and into Sharpsburg Borough.

In Sharpsburg Borough, the route extends in a westerly direction from the PennDOT Highway crossing through an industrial park and along 23rd Street, Noble Street, Front Street, 18th Street, Middle Street, 13th Street, School Street, Penn Street, and Garnier Street to Main Street. From Main Street, the route extends under the PennDOT Highway 28 and 8 interchange as well as Pine Creek and into Etna Borough.

In Etna Borough and Shaler Township the route extends in a westerly direction from the PennDot Highway 28 and 8 interchange along Finney Street, Cherry Street, Clark Street, and Butler Street to Parker Street. At Parker Street the route extends in a north westerly direction along Parker Street, Washington Street, Nauman Street, through a wooded right-of-way, and into the Lanpher Reservoir property.

The total length of the proposed rising main shown as Alternative Route No. 3 is 21,072 feet. An additional length of 1,281 feet of pipe would be required to connect the proposed rising main with the existing system at each of the active service connections.

3.3 Hydraulic analysis

3.3.1 Model objective

Mott MacDonald performed a hydraulic analysis of potential rising main diameters using Bentley WaterGEMS software. The model was developed for the purpose of determining a rising main diameter that would allow PWSA to meet the primary and secondary objective of this report as detailed in Section 1.0. The existing rising main is a 60-inch diameter riveted steel pipeline.

To meet the primary objective of this report, the new rising main would provide redundancy to the existing rising main by providing the same level of service as the existing rising main; by providing treated drinking water to the Lanpher Reservoir and to the existing service connections. The redundant rising main could be operated by PWSA in parallel with the existing rising main or it could be placed in service as the main conduit with the existing rising main utilized as a backup system. Existing service connections would be connected to the new rising main. Potential new service connections could be installed at strategic locations on the new rising main to serve additional customers in the future.

To meet the secondary objective of this report, chlorinated water would be pumped through the new rising main directly to the Lanpher Reservoir. Following the required CT in the reservoir, disinfected potable water would exit Lanpher Reservoir and return through the existing rising main to each of the service connections and Fox Chapel Pumping Station.

3.3.2 Model construction

The model was developed in ArcGIS using the existing rising main, the proposed rising main, existing and proposed rising main interconnects, and 5-foot contour shapefiles. Performance curve data points for the existing Aspinwall Pump Station pumps were extracted from PWSA's existing InfoWater model and input into the WaterGEMS model. Table 3 provides pump information for the Aspinwall Pump Station. So as to represent current pumping operations, Aspinwall Pumps 1 and 2 were set with an initial status as being in operation, and Aspinwall Pumps 3 and 4 were set with an initial status as being offline in the hydraulic analysis.

Table 3: Aspinwall pump station pumps

Pump No.	Aspinwall Pumps			
	1	2	3	4
Capacity (MGD)	12	15	22	28
TDH (feet)	265	265	265	265
Motor (HP)	1,000	1,000	1,500	1,500

Existing pump and reservoir elevations from PWSA's "Pittsburgh Water System Schematic" were input into the model; node/junction elevations were assigned using the software's Terrain Extractor ("TRex") tool and the existing 5-foot contour shapefile. Five feet was then subtracted

from each node elevation to simulate the pipe's actual installed elevation. To account for minor losses throughout the system and the varying age of existing infrastructure, Mott MacDonald globally applied a Hazen Williams C-factor of 120 to each existing pipe. The existing rising main was modeled with a 60-inch inside diameter.

Meter data from 2012 to 2015 was used to determine monthly minimum, maximum, and average demands off of the existing rising main. Monthly average and monthly maximum demands were then input into the model. These demands were modelled in a steady-state mode with no diurnal fluctuations, as shown in Table 4.

Table 4: Modelled service area demand

Node Label	Average Daily Demand (gal/day)	Demand (gal/day) (Based on max. monthly)
Aspinwall 1	92,500	160,000
Aspinwall 2	92,500	160,000
Shaler	17,400	35,000
Sharpsburg	22,100	233,000
St. Margaret's Hospital	98,800	189,000
Water Works Mall	54,600	70,000
Fox Chapel	1,889,000	4,890,000
Total	**2.27 MGD**	**5.74 MGD**

The new rising main was modelled parallel to the existing rising main between the Aspinwall Pump Station and Lanpher Reservoir with a Hazen Williams C-factor of 130 at the diameters described in the scenarios below.

3.3.3 Scenarios

The following scenarios were analyzed to hydraulically model the existing and proposed new rising main system.

- Aspinwall Pumps 1 and 2 discharging through the existing 60-inch diameter Rising Main to Lanpher Reservoir with existing average day demands at the service connections.
- Aspinwall Pumps 1 and 2 discharging through the existing 60-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through a new 48-inch diameter rising main to the existing service connections with average daily demands.
- Aspinwall Pumps 1 and 2 discharging through the existing 60-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through a new 48-inch diameter rising main to the existing service connections with maximum monthly demands.
- Aspinwall Pumps 1 and 2 discharging through a new 48-inch diameter rising main directly to Lanpher Reservoir. Lanpher Reservoir draining back through the existing 60-inch diameter Rising Main to the existing service connections with average daily demands.
- Aspinwall Pumps 1 and 2 discharging through a new 48-inch diameter rising main directly to Lanpher Reservoir. Lanpher Reservoir draining back through the existing 60-inch diameter Rising Main to the existing service connections with maximum monthly demands.
- Aspinwall Pumps 1 and 2 discharging through the existing 60-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through a new 36-inch diameter rising main to the existing service connections with average daily demands.

- Aspinwall Pumps 1 and 2 discharging through the existing 60-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through a new 36-inch diameter rising main to the existing service connections with maximum monthly demands.
- Aspinwall Pumps 1 and 2 discharging through a new 36-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through the existing 60-inch diameter rising main to the existing service connections with average daily demands.
- Aspinwall Pumps 1 and 2 discharging through a new 36-inch diameter Rising Main directly to Lanpher Reservoir. Lanpher Reservoir draining back through the existing 60-inch diameter rising main to the existing service connections with maximum monthly demands.

As detailed above, it is anticipated that there will be three (3) trenchless crossing locations along each of the alternative routes that will be analyzed.

- 180 linear feet near the Aspinwall Pump Station
- 200 linear feet crossing the PA-18/Highland Park Bridge interchange
- 400 linear feet crossing the PA-28/PA-8 interchange

These three (3) sections of the new rising main will be modelled under the nine (9) scenarios to determine the most feasible crossing diameter.

3.3.4 Hydraulic criteria

The criteria for selecting the diameter of the new rising main is to maintain the ability to deliver the required flow to the Lanpher Reservoir while maintaining a velocity of between 2 and 8 feet per second through the pipe system.

3.3.5 Results

See Table 5 on the following page for a summary of the nine (9) scenarios. Based on the results, Mott MacDonald considers the most hydraulically practical new rising main to be 48 inches in diameter with reductions to 36-inch diameter at each of trenchless crossings. The scenarios that depict this configuration are Scenarios 2, 3, 4 and 5.

Under these scenarios, the Aspinwall Pump Station would deliver approximately 26.4 MGD through the 48-inch diameter new rising main at a velocity of approximately 3.2 feet/second and approximately 5.8 feet/second through the 36-inch diameter sections.

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Table 5
Hydraulic Model Results

	Scenario Description	Aspinwall PS Pump Flow (MGD)			Demand Total (MGD)	Inflow to Lanpher Reservoir (MGD)	Outflow from Lanpher Reservoir (MGD)	Demand-Aspinwall1	Demand-Aspinwall2	Demand-Fox Chapel	Demand-PA-8 / 28	Demand-Shaler	Demand-Sharpsburg	Demand-St. Margret's Hospital	Demand-Waterworks Mall
		Pump 1	Pump 2	Pump 3/4				Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)	Flow (GPD) / Pressure (psi)
1	Existing 60" rising main - Aspinwall PS to Lanpher Reservoir	12.86	15.40	OFF	2.36	25.90	0.00	92,500 / 100	92,500 / 100	1,888,700 / 75.5	92,500 / 104	17,400 / 15.8	22,100 / 102	98,800 / 96.4	55,600 / 101
2	Exist. 60" RM to Lanpher Reservoir (no demands); new 48" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	12.78	15.33	OFF	2.36	28.11	2.36	92,500 / 95.3	92,500 / 94.7	1,888,700 / 73.3	92,500 / 104	17,400 / 15.8	22,100 / 101	98,800 / 93.8	55,600 / 98.3
3	Exist. 60" RM to Lanpher Reservoir (no demands); new 48" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	12.78	15.33	OFF	5.9	28.11	5.9	231,250 / 95.1	231,250 / 94.4	4,721,750 / 49.9	231,250 / 104	43,500 / 15.8	55,250 / 101	247,000 / 93.5	139,000 / 98.0
4	New 48" RM from Aspinwall PS to Lanpher Reservoir (no demands), exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	11.85	14.59	OFF	2.36	26.43	2.36	92,500 / 98.5	92,500 / 98.4	1,888,700 / 73.3	92,500 / 104	17,400 / 15.6	22,100 / 101	98,800 / 94.4	55,600 / 99.1
5	New 48" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	11.85	14.59	OFF	5.9	26.43	5.9	231,250 / 98.5	231,250 / 98.3	4,721,750 / 50.5	231,250 / 104	43,500 / 15.6	55,250 / 101	247,000 / 94.3	139,000 / 99.0
6	Exist. 60" RM to Lanpher Reservoir (no demands), new 36" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	12.78	15.33	OFF	2.36	28.11	2.36	92,500 / 95.2	92,500 / 94.6	1,888,700 / 73.1	92,500 / 104	17,400 / 15.8	22,100 / 101	98,800 / 93.7	55,600 / 99.1
7	Exist. 60" RM to Lanpher Reservoir (no demands); new 36" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	12.78	15.33	OFF	5.9	28.11	5.9	92,500 / 94.3	92,500 / 93.6	1,888,700 / 49.0	92,500 / 104	17,400 / 15.8	22,100 / 100	98,800 / 92.6	55,600 / 97.0
8	New 36" RM from Aspinwall PS to Lanpher Reservoir (no demands), exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	9.32	12.63	OFF	2.36	21.95	2.36	92,500 / 98.5	92,500 / 98.4	1,888,700 / 73.4	92,500 / 104	17,400 / 15.6	22,100 / 101	98,800 / 94.4	55,600 / 99.1
9	New 36" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	9.32	12.63	OFF	5.9	21.95	5.9	231,250 / 98.5	231,250 / 98.3	4,721,750 / 50.5	231,250 / 104	43,500 / 15/6	55,250 / 101	247,000 / 94.3	139,000 / 99.0

3.4 Existing utilities

Mott MacDonald performed a One-Call request through the Pennsylvania One-Call System, Inc. for the purpose of understanding the locations and sizes of the existing underground utilities. In addition, Mott MacDonald performed a visual on-site review of above ground utilities that exist along the potential alignments. All One-Call information received is located in Appendix B. Figure 4 shows the location of above ground and below ground utilities that may potentially be impacted or disrupted during construction of the new rising main.

One-Call utility information was requested and received from the following utility owners:

- Aspinwall Borough
- Alleghany County Sanitary Authority (ALCOSAN)
- People's Gas
- Pittsburgh Water and Sewer Authority (PWSA)
- Girty's Run Joint Sewer Authority
- Hampton Township
- Shaler Township
- Duquesne Light

The following utility owners did not respond to the One-Call request or responded on a limited basis:

- Sharpsburg Borough
- Etna Borough (partial)

Aboveground utilities and water bodies were visually identified and researched. Above ground utilities and water bodies include the following:

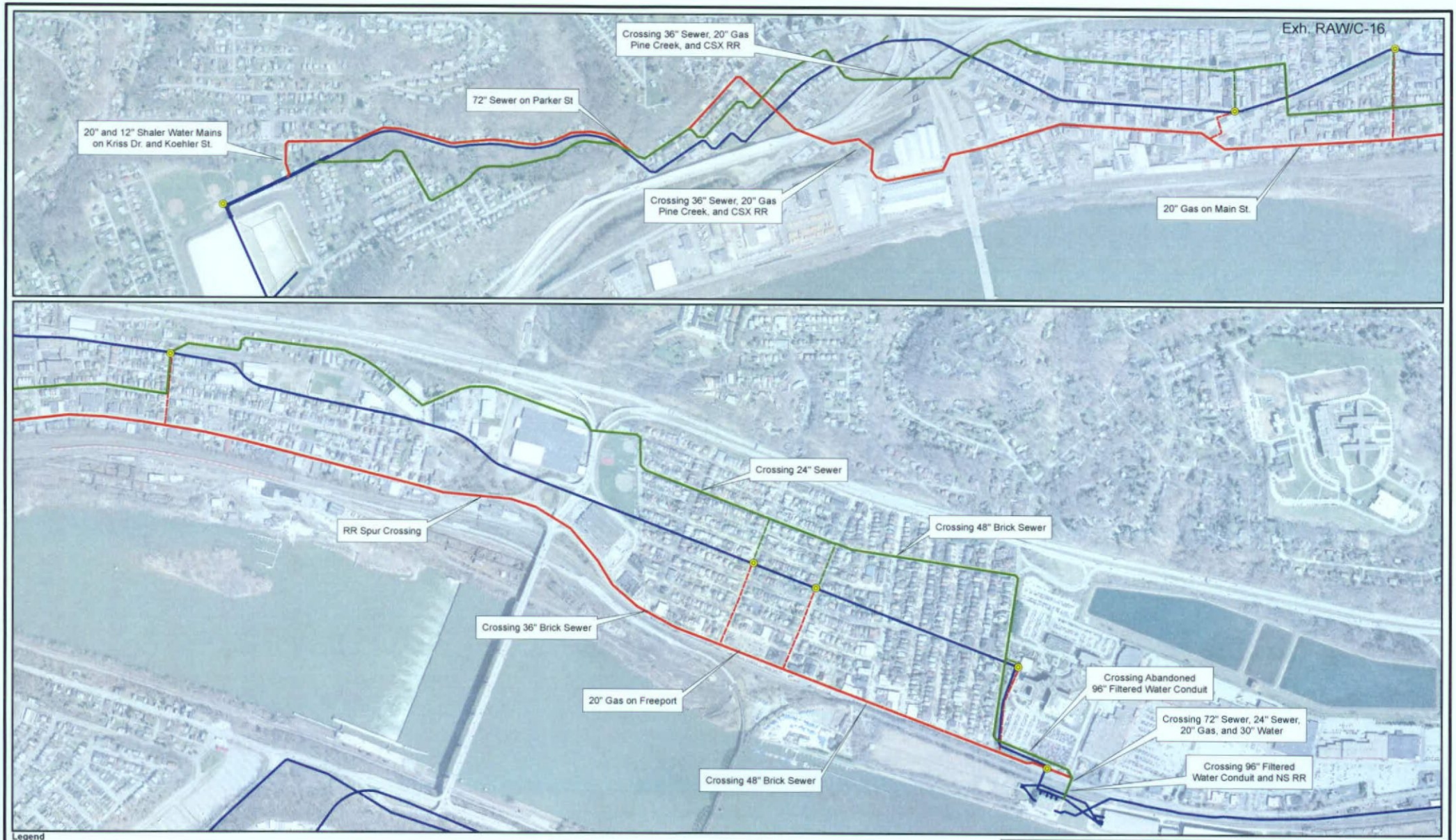
- Railroad
- PennDOT Highways and surface roads
- Pine Creek

3.4.1 Potential buried utility conflicts

Utilities identified in the One-Call request include potable water, sanitary sewer, combined sewer, and gas. Potable water and sanitary sewer pipe networks exist along most of the east-west streets and north-south avenues in Aspinwall Borough and are assumed to exist in Sharpsburg and Etna Boroughs and Shaler Township. Major buried utilities that may affect the alternative routes include the following:

- A PWSA 96-inch diameter filtered water pipe traverses parallel to the existing discharge manifold. In addition, an abandoned PWSA 96-inch filtered water pipe crosses Freeport Road as it extends north from the Clearwell Gate House.
- An ALCOSAN 24-inch diameter combined sewer pipe exists along Freeport Street in Aspinwall Borough
- A People's Gas 20-inch diameter high pressure gas main exists along Freeport Street in Aspinwall Borough and Etna Borough.
- A People's Gas 20-inch diameter high pressure gas main exists at the intersection of Butler and Parker Street in Shaler Township.

Exh. RAW/C-16



Legend

- Service Connections
- Alt_Route_2rev1
- Alternative Alignment 2
- Alignment 1 (Existing Rising Main)
- Crossover Connection Alt 2
- Crossover Connection Alt 3

0 500 1,000 Feet

PGH2O

MOTT MACDONALD

1600 W Carson St.
Pittsburgh, PA 15219

PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 4 - EXISTING UTILITIES

Designed	Drawn	Checked	Approved	Date
	DWW			10/11/2018

- An Aspinwall Borough 48-inch diameter brick combined sewer extends from Delafield Avenue to 4th Street and Brilliant Avenue in Aspinwall.
- A Shaler Township 72-inch diameter gravity sewer exists on Parker Street near the intersection of Butler Street in Shaler Township.
- An Etna Borough 36-inch diameter gravity sewer exists adjacent to Pine Creek in Etna Township.
- A Shaler Township parallel 20-inch and 12-inch diameter water main exists on Kriss Drive and Koehler Street in Shaler Township

3.4.2 Potential major aboveground utility conflicts

Visual on-site observations of aboveground utilities that may affect the alternative routes include the following:

- A Class I Norfolk Southern railroad line extends adjacent to Freeport Street and Main Street, adjacent to the Alleghany River and adjacent to the PWSA Drinking Water Plant in Aspinwall.
- A spur off of the Norfolk Southern railroad line extends into the PWSA Drinking Water Plant and is utilized for the delivery of water treatment chemicals and equipment.
- Freeport Road located just outside of the PWSA Drinking Water Plant, is owned by PennDOT.
- The Highland Park Bridge at the border of Aspinwall and Etna is owned by PennDOT.
- PennDOT Highway 28 runs along the northern border of Aspinwall and Sharpsburg and intersects with Highway 8 in Etna.
- PennDOT Highway 8 intersects with Highway 28 in Etna.
- Pine Creek extends beneath and adjacent to the Highway 28 and Highway 8 interchange in Etna.
- A Class I CSX railroad line extends adjacent to Pine Creek at the Highway 28 and 8 interchange.
- Overhead electrical lines exist throughout each of the boroughs and in Shaler Township.

3.5 Construction methods and evaluation

The new rising main will be constructed primarily through residential and light commercial locations in Aspinwall, Sharpsburg, and Etna Boroughs and Shaler Township. However, there are locations where the new rising main will need to extend across highways, railroad tracks, and water bodies as well as locations where existing utilities exist. At these locations, trenchless methods of construction will be considered.

Several factors should be considered when evaluating construction methods of a water main.

- Pipe diameter and pipe material
- Desired pipeline depth
- Soil material and characteristics
- Depth to rock along potential pipe alignment
- Groundwater elevation
- Final pipe alignment
- Regulatory requirements
- Adequate access and size of construction area

- Impacts to residents/business and traffic
- Construction cost

This section will describe open cut and trenchless construction methods and their feasibility at the potential new rising main alignments based on the factors listed above.

3.5.1 Methods of construction

3.5.1.1 Horizontal directional drilled (HDD)

This method has been used for major and minor crossings of bodies of water and highways and has been previously utilized successfully by a number of projects throughout the country. Using this technology, the pipeline can be installed on both a horizontal and vertical curve. The most significant aspect of this method as it relates to this specific project is the required laydown area for the casing and/or carrier pipe, which would generally be at least as long as the proposed installation length and the necessary staging area of the entry point side (drilling rig side). Typical space requirements for these size crossing will be approximately 100 feet wide by 100 feet long to allow for the staging of drilling equipment (i.e. drilling rig, drilling pipe, slurry mixing tank, cuttings separation equipment, pumps, etc.) and for maneuvering of construction equipment. However, it is noted that the width of the staging area can be reduced to the width of the drilling rig with the ancillary drilling equipment arranged linearly. If a linear arrangement of drilling equipment were to be utilized, the staging area could potentially be reduced to a width of approximately 25 feet.

3.5.1.2 Auger boring

Auger bores push or drive casing pipe into the ground and use continuous augers to remove material. If the casing is pushed, the auger will typically advance ahead of the casing. If the casing is pneumatically driven into place (pipe ramming), the auger will typically trail the casing. A plug of soil can be utilized to maintain face stability; however, the soil is not conditioned and may not be effective. Obstructions can be difficult to pass. The machine is advanced from an excavation by jacking casing pipe in behind the machine. Auger bores can only accommodate straight drives.

3.5.1.3 Micro-tunneling

Micro-tunneling is one of the many existing trenchless construction methods used to install underground pipelines. The method utilizes a pressurized Slurry Shield Boring Machine combined with the pipe jacking technique. It is a remotely controlled process operating from a control panel, guided to meet the required tolerance for line and grade, and continuously applying pressure to the face of the excavation to balance groundwater and earth pressures. Micro-tunneling is a steerable jacking method that requires less lay down area than horizontal directional drilling. Since the cutting head of the micro-tunneling machine is pressurized, it can operate in a wide variety of ground conditions, including wet sands and silts. Typical jacking pipes are either steel or concrete, although fiberglass and ductile iron pipe can also be utilized.

The advantage of installing the pipeline utilizing the micro tunneling method is that it is not necessary to string out the pipeline. Temporary jacking and reception shafts are constructed to jack the casing and/or carrier pipes in place.

3.5.1.4 Open-faced pipe jacking

Open-face pipe jacking is more commonly used in pipe diameters larger than 48 inches because it requires man entry. Open-face pipe jacking is typically performed above the water table or in conjunction with dewatering to control the mining face. Obstructions are more readily removed with open-face pipe jacking because laborers can split and remove larger obstructions.

3.5.1.5 Conventional tunnel boring machine (TBM)

Under this method, an available conventional TBM would be utilized to excavate a rock tunnel that is supported using steel ribs and lagging with a secondary carrier pipe installed to complete the lining. Unlike micro-tunneling, conventional tunneling can easily traverse more than a mile without the need for an intermediate shaft, and curves in the alignment can be incorporated in the tunnel.

3.5.1.6 Open cut

Open cut construction utilizes excavation equipment to dig a pipe trench to a depth below the desired invert of the pipe system. If deemed suitable, excavated earth is removed and stored on-site to be utilized as fill material to bed and secure the new pipe system. To allow for proper installation, the pipe trench is typically excavated to a width of approximately 1.8 times the diameter of the new pipe. A trench box can be used to secure a shallow pipe trench allowing for the trench to be excavated with 1:1 walls. A deeper pipe trench will require 1.5 or 2:1 walls which widens the width of the pipe trench and increases the volume of excavated earth.

3.5.2 Evaluation

Based on the findings of Section 3.3, the proposed new rising main is recommended to be a 48-inch diameter pipeline with 36-inch diameter segments utilized at the trenchless crossings. Ideally, the new rising main will be installed at a minimum depth of 5 feet so that the PWSA can easily access, operate, and maintain the system. Based on the alternative routes summarized in Section 3.3, the alignment of the new rising main will require frequent fittings to change the direction of the rising main in order to traverse through the existing right-of-ways. Whenever a fitting is placed on the pipeline to change the direction of the alignment, a thrust force is created which must be restrained in order to prevent separation of the pipe joints.

Due to these factors, Mott MacDonald believes that the most feasible method of installing the new rising main in locations where trenchless installation is not required is with open cut construction. Open cut construction will allow for the PWSA to install the rising main at minimal depths and to maintain the location of the new rising main within public right-of-way.

At locations where open-cut installations are not practical or feasible, trenchless crossings will be required. The trenchless crossing locations are evaluated below in order to determine the most feasible methods of installation.

3.6 Trenchless crossings

Locations where trenchless construction methods will likely be required are shown on Figure 3. As shown, the alternative routes include three (3) crossings at PennDOT highways, railroad tracks, major surface roadways, and water bodies. An initial discussion with owner agencies for each location indicates that open cut construction across these locations will more than likely not be allowed.

3.6.1 Description

Trenchless Crossing 1 is located at Freeport Street near the Pittsburgh Drinking Water Plant. The crossing will extend along a straight alignment beneath Freeport Street and railroad tracks owned by the Norfolk Southern Railroad as well as beneath a 96-inch diameter filtered water pipe at the PWSA Drinking Water Plant, an ALCOSAN 24-inch diameter sewer along Freeport Street, and a 20-inch diameter gas main on Freeport Street. Trenchless Crossing 1 will extend approximately 180 feet from the Pittsburgh Drinking Water Plant to a parking lot across Freeport Street.

Trenchless Crossing 2 is located at the PennDOT Highland Park Bridge at the border of Aspinwall and Sharpsburg. There are no known buried utilities or surface utilities at this crossing. Trenchless Crossing 2 will extend approximately 200 feet from the Aspinwall Borough playground and baseball field in Aspinwall to an industrial park complex in Sharpsburg Borough. The crossing will run beneath the Pennsylvania State Highway 28 Exit 6 entry and exit ramps.

Trenchless Crossing 3 is required to cross the Pennsylvania State Highway 8 and Pennsylvania State Highway 28 interchange and Pine Creek. The proposed crossing will begin north of North Main Street at the intersection of Bridge Street and continue west under Pine Creek to a location north of Bridge Street. Buried utilities in the area include a 12-inch diameter water main, a high-pressure gas transmission main owned by People's Gas, and a 36-inch diameter sanitary sewer owned by Etna Borough. Surface utilities at this crossing include a CSX Rail Line and Pine Creek. Pine Creek runs north-south through the PennDOT interchange. The creek bed is about 20 feet below grade at this location. Trenchless Crossing 3 is proposed to extend a length of about 365 feet from a parking lot off of North Main Street to a parking lot off Bridge Street, adjacent to the rail line.

3.6.2 Geotechnical conditions

Mott MacDonald performed a desktop evaluation of existing geotechnical borings at the three (3) trenchless crossings as shown on Figure 5. In addition, one (1) subsurface geotechnical boring was performed at Trenchless Crossing 2. All of the geotechnical information that was obtained is located in Appendix C of this report.

Trenchless Crossing 1 is located about 400 feet north of the Allegheny River with a surface elevation of about 745 feet. The general soil conditions are expected to be 5 to 10 feet of the Urban Land soil composed of heterogeneous fill and by 50 feet of glacio-fluvial sediment. Directly underlying the fill is a stratum of saturated sand and silt with very low strength. The historical borings at the location of the Drinking Water Plant indicate 5 feet to 25 feet of fill underlain by about 10 feet of soft silt and sand followed by medium dense to dense sand and gravel. Bedrock consisting of shale was encountered at approximately Elevation 670. The bedrock is in the lower portion of the Glenshaw Formation of the Conemaugh Group of Pennsylvanian age. This portion of the stratigraphic section includes sandstone, siltstone, and shale with minor limestone and coal. Groundwater has been recorded from the historical borings between Elevation 735 feet and 725 feet and as low as Elevation 707 feet. No mining is reported in the vicinity.

Exh. RAW/C-16



Legend

- Test Borings
- RisingMain

0 100 200 Feet

PGH2O

MOTT MACDONALD

1600 W Carson St.
Pittsburgh, PA 15219

PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 5 - GEOTECHNICAL INVESTIGATION
(BORING LOCATIONS)

Designed	Drawn	Checked	Approved	Date
	DWW			3/9/2016

Trenchless Crossing 2 is located near the north side of the Allegheny River valley at the Exit 6 ramps for State Road 28, at an elevation of about 770 feet. It is underlain by the Urban Land Rainsboro complex soil, which is composed mainly of heterogeneous fill and anticipated to be 5 to 15 feet thick. The fill is underlain by glacio-fluvial sediments, which are up to 50 feet thick in the central part of the Allegheny Valley. One (1) geotechnical boring was completed in the vicinity of the crossing. A 49-foot thick stratum of alluvial clay underlain by 29 feet of silt was encountered at the boring. Possible sandstone was encountered 49 feet below ground surface elevation at approximately Elevation 720 feet. This bedrock is in the middle of the Glenshaw Formation of the Conemaugh Group of Pennsylvanian age and is expected to consist of sandstone, siltstone, and shale with minor limestone and coal. No mining is reported in the vicinity.

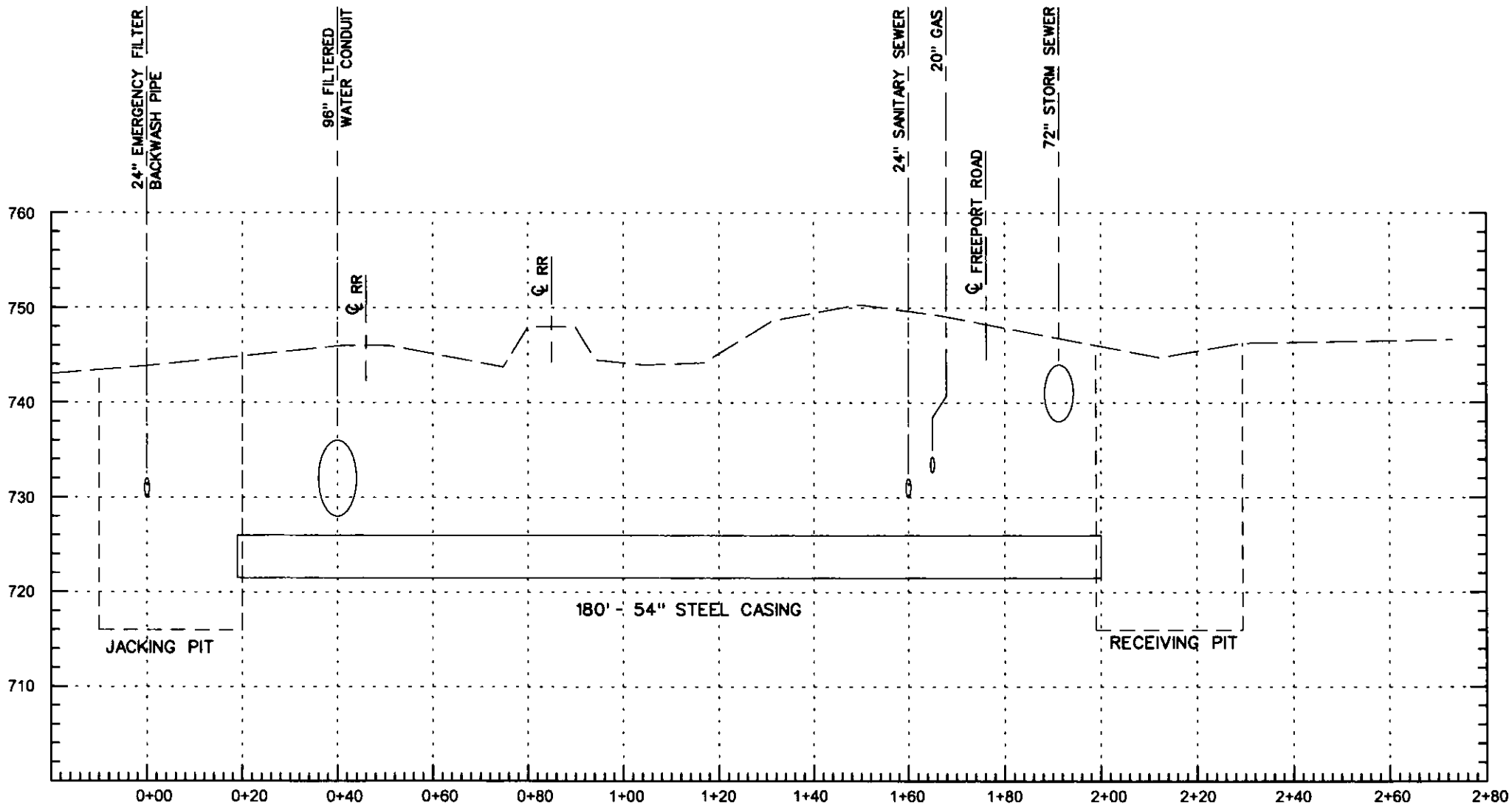
Trenchless Crossing 3 is located at the Pennsylvania State Road 28 and State Road 8 intersection in Etna. This area has a ground surface elevation of about 730 feet. Much of this area contains the Urban Land Rainsboro complex soil, which is composed mainly of heterogeneous fill. The fill is underlain by glacio-fluvial sediments, which are found to be up to 50 feet thick in the central part of the Allegheny Valley. The historical borings closest to this site indicate little fill underlain by glacio-fluvial sediments, typically consisting of clay to sandy clay. Bedrock was typically encountered 20 to 30 feet below existing ground surface and 5 to 8 feet below Pine Creek. The bedrock consists of sandstone overlain by fractured shale that seams out to the east. The elevation of competent bedrock was approximately Elevation 710 feet. This bedrock is in the lower portion of the Glenshaw Formation of the Conemaugh Group of Pennsylvanian age and is expected to consist of sandstone, siltstone, and shale with minor limestone and coal. No mining is reported in the vicinity.

3.6.3 Trenchless evaluation

Mott MacDonald evaluated each trenchless crossing by analyzing the potential design and construction risks for each alignment. Specifically, different types of tunneling methodologies were contrasted with project conditions and assessed for feasibility. These risks were contrasted against each other to identify the tunneling method that is perceived to have the least risk.

3.6.3.1 Trenchless Crossing 1

As described previously, there are several utilities located along the alignment of Crossing 1. The deepest of these is a 96-inch filtered water pipe with invert elevation at approximately 728 feet. Maintaining a minimum clearance equal to one diameter of the bore, the invert of the crossing will be at approximately Elevation 722 feet. A 54-inch casing pipe is proposed to accommodate a 36-inch product pipe. The trenchless crossing may encounter fill as well as silt and sand deposits. Obstructions included within the fill deposits may be within the tunnel alignment. The borings indicate that silt and sand layers are of low strength with N-values between 0 and 2. The tunnel alignment is also expected to be below the groundwater table.



Pittsburgh Water and Sewer Authority
Lanpher Rising Main
Figure 6
Trenchless Crossing No. 1

> Crossing method

A profile of Trenchless Crossing No. 1 is shown in Figure 6. Potential trenchless construction methods were evaluated based on cost and construction risk. Auger boring in conjunction with pipe ramming is the method that appears to be the best value while also managing the potential construction risks. The crossing will be within soft ground and will be relatively short in length. Several risks exist that may require mitigation during design and construction. The site is likely to contain natural and manmade obstructions from fill operations, which can impede or halt the advance of a jacked pipe if located within the path of the casing pipe. Similarly, obstructions greater than a third of the diameter can be difficult to remove with the continuous augers used for excavation during pipe jacking, even if the obstructions are located within the center of the jacked pipe. Groundwater control can be difficult with an auger bore because no positive pressure is applied to the tunnel face. Dewatering may be able to be utilized to locally lower the groundwater table and create a more stable face condition. Alternatively, pipe ramming or pneumatically ramming the casing pipe into place can provide additional face stability and increase the ability to drive through obstructions. The space between the casing and the carrier pipe can be backfilled with grout or left open. The shafts can also be backfilled or built out with permanent liners.

3.6.3.2 Trenchless Crossing 2

Crossing 2 will extend under the SR 28 Exit 6 ramps connecting to Highland Park Bridge. The ramps are located on an embankment as well as elevated on overpasses supported by bridge piers. The bridge piers are typically constructed on pile caps supported by piles of unknown length. The crossing is proposed to be beneath the embankments and will traverse between two (2) bridge pier foundations supporting the SR 28 eastbound exit ramp. The pier to the north supports the single lane exit ramp while two (2) piers to the south support the pile cap under the two-lane merge between eastbound exit ramp and the westbound exit ramp. To the north of the merge on the westbound exit, the ramp is constructed on an embankment and supported by a shallow abutment. It is anticipated this option will require the pipe to be installed approximately 25 to 35 feet from the bridge piers to the north and south to reduce the risks of construction impacts on the ramps.

The industrial park complex in Sharpsburg Borough was likely constructed on a large cut area, resulting in a ground surface elevation 10 feet below the natural elevation of the baseball field on the west side of the SR 28 Exit 6 ramps. In order to provide adequate cover at this location, the centerline of the crossing will be installed at an approximate elevation of 752.8 feet, providing approximately 3 feet of cover between the ground surface of the parking lot and the top of the casing. A 54-inch diameter casing is proposed at this crossing to accommodate the 36-inch pipe. Based on the subsurface conditions encountered at the boring done in the baseball field, the crossing will likely be within stiff to hard clay.

Groundwater was encountered 45 feet below ground surface, at approximate Elevation 724 feet. As such, groundwater is not expected to be encountered during the construction of the crossing. The rising main will enter or exit through a vertical shaft in the baseball field which will require 90 degree bends. The pipe will cross the PennDOT right-of-way from the baseball field to the industrial park complex parking lot where a shallow pit will be required to retrieve or jack the pipe.

- Crossing method

A profile of Trenchless Crossing No. 2 is shown in Figure 7. Potential trenchless construction methods were evaluated based on cost and construction risk. Auger boring is the method that appears to be the best value while also managing the potential construction risks. The crossing will be within stiff clay and will be a relatively short crossing. An auger can be used to advance the pipe casing, and the cuttings are transferred out by the blades of the continuous flight helical auger. There are several risks that may require mitigation during design and construction. The typical subsurface profile for the crossing was determined based on a single geotechnical boring and may not be representative of the entire crossing. The embankments for the highway ramps are likely large areas of fill which may extend into the area of the auger bore. Obstructions from fill operations can impede or halt the advance of a jacked pipe if located in the path of the casing and may be difficult to remove with the continuous augers used to excavation during pipe jacking. Groundwater is not expected to be encountered during construction, but localized dewatering in the jacking and receiving pits may be required to maintain a dry excavation. The space between the casing and the product pipe can be filled with grout or left open. The shafts can also be backfilled or built out with permanent liners.

3.6.3.3 Trenchless Crossing 3

The proposed location of Crossing 3 is near many existing highway overpasses. SR 8 is located on an elevated structure directly over the proposed alignment as is the entrance ramp from SR 28 eastbound and exit ramp to SR 28 westbound. These structures are supported on several bridge piers which are typically supported on shallow foundations. Bridge Street and North Main Street are located directly south of the proposed crossing, and the existing rising main is located to the north. An abandoned rail bridge parallels Bridge Street to the north over Pine Creek. Pine Creek is a channelized flow in this area approximately 16 feet below the average ground surface elevation. An active rail line parallels the exit ramp to SR 28 westbound. The distance between weathered bedrock and the channelized cut for Pine Creek appears to be between 5 and 8 feet. This will provide insufficient cover between the creek and the crown of a proposed crossing. Additionally, the walls to the channelized flow are embedded below the creek bottom. Most trenchless methods are ineffective or inefficient in highly fractured rock, which requires moving the crossing down into the competent bedrock. A minimum amount of cover from the top of rock would be required to allow the tunnel to be completely driven in competent rock. Additionally, tunneling in soft ground below or adjacent to the bridge piers should be avoided as construction could induce settlement on the existing bridges. Locating the crossing in rock will significantly lower the risk of settlement to adjacent structures. The shafts are proposed to be located approximately 365 feet apart to allow each shaft to be constructed without overhead clearance restrictions.

Groundwater is assumed to be at or slightly above the level of Pine Creek which is approximately 25 feet higher than the proposed tunnel invert. If the bedrock is massive with few fractures, the tunnel may not experience a significant amount of hydrostatic pressure. Both the launch and receiving pits will require watertight excavations or localized dewatering to maintain a dry excavation. The proposed rising main will enter and exit the crossing through vertical shafts which will require 90-degree bends.

- Crossing method

A profile of Trenchless Crossing No. 3 is shown in Figure 8. Potential trenchless construction methods were evaluated based on cost and construction risk. Closed-face micro-tunneling is the method that appears to be the best value while also managing the potential construction risks. Micro-tunneling can be utilized to bore through sandstone below the water table. The

cutter head can be equipped with tooling such as disk cutters and rippers that are able to bore through the bedrock and cuttings are piped out in a slurry suspension. The machine is advanced with a typical pipe jacking procedure, adding additional lengths of casing from the jacking pit. The jacking pipe is typically oversized, and the product pipe will be inserted into the bore at completion. A 54-inch casing is proposed at this crossing to accommodate the 36-inch pipe. The annulus around the product pipe can then be filled with grout or left open. The shafts can also be backfilled or built out with permanent liners.

3.7 Evaluation of pipe materials

The pipe materials included in this evaluation are ductile iron pipe (DIP), pre-stressed concrete cylinder pipe (PCCP), steel pipe, polyvinyl chloride pipe (PVC), high-density polyethylene pipe (HDPE), and fiberglass reinforced pipe (FRP).

Based on the probable profile of the new rising main and existing PWSA Aspinwall Pump Station pump data, it is anticipated that the normal working pressure of the new rising main at the lowest elevation will be approximately 110 PSI, and the test pressure will be 200 PSI.

Pipe materials will be evaluated based upon their ability to meet the design pressure conditions, ease of installation, joint restraint types, bedding and backfill requirements, availability of fittings for field adjustment, relative corrosion resistance, tapping considerations, longevity, and cost.

3.7.1 Design loading conditions

The proposed rising main must be designed to meet internal loads (i.e. the water pressure) and external loads (the soils surrounding and above the pipe plus any dead or live loads on the ground surface above the pipe). Given the variations in the nature of the potential alternative pipe materials, a direct comparison of alternatives can be a challenge. A particular issue that can skew the comparison, especially with regard to cost, is the factors of safety that is either inherent in the applicable industry standards or written into the project specifications. Therefore, this analysis attempts to provide a fair comparison with comparable factors of safety in the design parameters for each alternative.

Several factors are relevant to the design pressure rating of a pipeline. Industry practice for accommodating the design pressure criteria may vary among alternate materials. Working pressure is the normal operating pressure. Field test pressure is the pressure applied to the completed pipeline, in the field, to test for leaks. Typically field test pressures are specified as 1.25 to 1.5 times the working pressure. The pipe material and the pipeline restraint systems must be selected and designed to accommodate the field test pressure. A surge pressure allowance is inherent in the design of certain pipe materials, whereas it must be specified in others. Ductile iron pipe has a 100 PSI surge allowance above and beyond the rated working pressure. However, if the pipeline restraint system is not designed for this additional pressure, then the ability of the pipeline to withstand surge pressures will be limited to the design field test pressure. Absent a surge analysis, it is usually assumed that a field test pressure of 1.5 times working pressure will provide sufficient capacity for the pipeline to withstand surges.

For purposes of this comparison, it is assumed that surge pressure will not exceed 200 PSI, and therefore, all alternative pipeline materials would need to be selected and designed for 200 PSI field test pressure.

Exh. RAW/C-16

Pittsburgh Water and Sewer Authority
Lanpher Rising Main
Figure 8
Trenchless Crossign No. 3

3.7.2 Corrosivity

A site-specific corrosivity study required for this project has not been conducted at the time of this analysis. This study should be conducted during the design phase after the final pipeline alignment has been determined.

Preliminary indications are that at least some type of minimal corrosion protection will be required for the new rising main. However, a general discussion of typical corrosion protection measures for each alternative is provided.

Absent any unusually corrosive conditions, it is not expected that resistance to corrosion would be a deciding factor in selection of pipe material for this project. However, it is recommended that this matter be revisited through a corrosivity field investigation. An evaluation of the corrosion potential of soils along the final pipeline alignment will be made by examining soil chemistry parameters (resistivity, redox potential, pH, sulfides, and moisture) against the Ductile Iron Pipe Research Association's (DIPRA) guidelines. In general, soils along the route that are found to be corrosive to ductile iron pipe will also be corrosive to bare steel pipe. If steel pipe is determined to be an acceptable pipe material, it is anticipated that the pipe will be furnished with an exterior tape coating, bonded or welded joints, and test stations. The bonded joints and exterior tape coating will permit a cathodic protection system to be installed in the future if necessary. Pre-stressed concrete cylinder pipe is affected by three (3) soil chemistry parameters that are not typically measured for ductile iron pipe evaluations, namely total acidity, sulfates, and chlorides. If PCCP is determined to be an acceptable pipe material, these parameters should also be determined.

An evaluation for the potential for stray current corrosion from potential adjacent utilities (cathodically protected petroleum and gas pipelines) should also be considered during the corrosivity field investigation.

3.7.3 Rising main pipe materials

3.7.3.1 Ductile iron pipe

For 48-inch, diameter Pressure Class 200, ductile iron pipe has a wall thickness of 0.52 inches which would have a working pressure rating of at least 200 PSI.

Ductile iron pipe also has an inherent surge pressure allowance of 100 PSI above the rated maximum working pressure. The presumption of this analysis is that the pipeline restraint systems will be designed for 200 PSI field test pressure.

Regarding ease of installation, ductile iron pipe, depending upon thickness, may be considered a flexible or semi-rigid pipe, which means its resistance to external loads is partially dependent upon the soil envelope surrounding the pipe. Therefore, reasonable care must be taken to provide proper bedding and backfilling. Jointing is relatively simple, especially for non-restrained joints, and no special treatment of the external coating or internal lining is required after jointing.

Regarding longevity, ductile iron pipe, and its cast iron predecessor, has a long history of installations around the country that have been in service for many decades and in older cities for over 100 years.

3 7 3.2 Pre-stressed concrete cylinder pipe

Pre-stressed Concrete Cylinder Pipe (PCCP) is manufactured based upon the specified internal and external loading conditions in accordance with AWWA Standard C301. PCCP can be designed to handle the 200 PSI field test pressure. For purposes of cost comparisons to ductile iron pipe with a comparable factor of safety, material prices were requested from PCCP manufacturers with a 200 PSI maximum pressure rating.

PCCP is commonly used in large transmission mains of similar size and pressure requirements to this project. PCCP joints are typically of the bell and spigot type with rubber gasket. Exposed metal at the joints are protected by a plastic or cloth diaper filled with flowable grout. Fittings for PCCP are custom fabricated for the specific angle required. Therefore, there is little room for field adjustment of the alignment when PCCP is used. Typically, several small spare harnessed deflection joints can be provided on a construction site to make minor horizontal or vertical adjustments.

Regarding ease of installation, PCCP is considered to be a rigid pipe, and therefore, is less dependent upon the soil envelope for its strength and more forgiving to inadequate bedding or backfill. All field joints, whether restrained or not, require field mortaring, which adds to installation labor cost. A unique characteristic of PCCP is that the manufacturer will design several different pipe sections for the same project with variations in steel cylinder thickness, wire diameter, and wire spacing. The variations are generally driven by depth of bury and by longitudinal stress associated with thrust from changes in pipeline direction. Extra care must be taken during construction to ensure that the correct pieces of pipe are used as the installation progresses.

In terms of longevity, PCCP has a shorter history than ductile iron. However, there are many PCCP water transmission mains that have now been in service for 40 to 50 years without significant problems.

PCCP pipe is manufactured in standard 20-foot lengths. Special short lengths can be fabricated and are used to meet critical points such as valves, bends, or connections.

3 7 3.3 Steel pipe

Welded steel pipe is manufactured in accordance with AWWA C200. The welded steel pipe wall thickness is based upon the specified internal and external loading conditions. Based upon a 200 PSI field test pressure, and assuming Type 2 bedding and haunching, a Class 200 pipe is recommended.

Steel pipe joints can be either bell-and-spigot gasketed or continuous fillet welded lap joints. Restrained sections are normally constructed using field-welded lap joints. Steel fittings are fabricated from cut and mitered steel pipe and are custom fabricated to the angle required. The ability to cut and weld the steel pipe allows for some alignment adjustment in the field.

Regarding ease of installation, steel pipe, unless thicknesses are very conservative, is a flexible pipe, which means it's resistance to external loads is partially dependent upon the soil envelope surrounding the pipe. Therefore, reasonable care must be taken to provide proper bedding and backfilling. Jointing of non-restrained joints is straight-forward. Restrained joints require the additional labor of welding followed by field coating and lining of the joints. This can increase installation costs in pipelines with many fittings and restrained joints. Conversely, on pipelines with long straight runs in open areas, steel pipe could be furnished in lengths up to 40 or 50 feet, reducing the number of joints and reducing installation costs.

In terms of longevity, steel pipe for large diameter transmission mains was commonly used in the late 1800's and early 1900's in several East Coast urban areas, and many of those mains remain in service today.

3.7.3.4 PVC pipe

PVC pipe in 48-inch diameter is manufactured in accordance with AWWA C905. PVC pipe classes are defined by the dimension ratio (DR), which is the ratio of the outside diameter to the wall thickness of the pipe. The smaller the DR, the thicker the pipe. The smallest DR commonly specified for 48-inch diameter PVC is DR21 (maximum pressure rating of 200 PSI). The maximum pressure rating is the maximum pressure that can be applied assuming a surge pressure of zero. In order to provide the same pressure ratings and safety factor as the other types of pipe, the dimension ratio would have to be DR14.

PVC pipe must be protected from external damage during installation and backfilling. Backfill must be free of materials that may impose point loads on the pipe.

While there is a good history of the use of PVC for water distribution mains in certain areas of the country, the use of PVC for large diameter transmission mains in the pressure ranges anticipated for PWSA's rising main have not been proven and, therefore, longevity for this project is difficult to evaluate.

3.7.3.5 HDPE pipe

HDPE pipe that is 48 inches in diameter is manufactured in accordance with AWWA C906. HDPE pipe classes are also defined based upon their DR. Considering 48-inch DR 13.5 HDPE pipe, the wall thickness would be 3.763 inches (DIPS pipe size). Since HDPE pipe is typically extruded in standard ductile iron pipe size outside diameters, this would mean that the pipe would have an inside diameter that is smaller than the nominal inside diameter for ductile iron, steel, or PCCP. This pipe would also have a working pressure rating of 160 PSI, which is inadequate for this project. The allowable maximum surge pressure above the working pressure rating for DR13.5 pipe for occasional surge events is 160 PSI. As detailed in AWWA C906, occasional surge events are caused by emergency operations and usually the result of a fire flow or a malfunction, such as a power failure or system component failure, which includes a pump seize-up, valve stem failure and pressure relief valve failure.

HDPE pipe manufacturers have recently developed a new formula for HDPE pipe, which is known as PE 4710. This formula has a higher strength than the current AWWA PE 3408 approved pipe. PE 4710 pipe is not covered by an AWWA standard as of the date of this evaluation

HDPE pipe is more susceptible to external damage during installation than DIP, steel, or PCCP. Special precautions are necessary during backfill and installation in order not to gouge the pipe exterior.

3.7.3.6 Fiberglass reinforced pipe

Centrifugally cast, fiberglass reinforced, polymer mortar pipe (CCFRPM) is a fairly recent entry into the potable water transmission main market. The pipe is a composite that contains glass fibers reinforcing mortar. CCFRPM pipe is available in sizes from 1 through 156-inch diameter. The manufacturing process for fiberglass pipe is described in AWWA C950.

CCFRPM pipe is available in pressure classes up to 450 PSI. For pressure pipe installations, CCFRPM pipe is usually jointed with FW Coupling (FWC) joints. The FWC joint consists of a structural filament wound sleeve over-wrapped and mechanically locked to an internal gasket.

The seal includes both lip and compression elements to achieve a watertight seal for maximum sustained operating pressures up to 450 psi. Special molded fittings are available for CCFRPM pipe. The pipe can also be manufactured to be compatible with standard ductile iron fittings.

Thrust blocks are the most practical method of restraining fiberglass pipe. A tied restraint joint system utilizing either flanged joints or laminated joints that are fabricated in the field can also be used for thrust restraint. However, pipe manufacturers do not recommend flanged joints and laminated joints as they are time-consuming, expensive, and it is difficult to control the quality in the field. The order of preference for thrust restraint alternatives by the pipe manufacturers are thrust blocks, axial reinforced concrete encasement, piles in shear, flanged joints, and laminated (tied) joints. Due to the size of the pipe and the test pressure, the required concrete thrust blocks for a 48-inch diameter pipe at 200 psi test pressure would be large. Fittings may also require full encasement in reinforced concrete to prevent deformation.

The use of fiberglass pipe for water transmission mains is relatively uncommon and therefore, there is not a wealth of experience from which to judge longevity.

3.7.3.7 Acceptable Pipe Materials

DIP, PCCP, and steel pipe all have a proven history of successful installations for similar sized projects throughout the United States. These three (3) pipe materials have been in service for many decades providing potable water supply to customers, and each material can be engineered and manufactured to meet the project design requirements. DIP, PCCP, and steel pipe are considered to be acceptable pipe materials for use on this project.

However, on the basis of their inability to meet the pressure requirements of the project, the need to provide thrust restraint through the use of concrete blocking, and due to a lack of experience in large diameter water transmission mains, it is not recommended that PVC, HDPE, or FRP be considered for this project. For purposes of this evaluation, PVC, HDPE, and FRP will no longer be considered.

3.7.4 Thickness design

All pipe installed by open cut will be bedded on a minimum 6 inches of quarry-processed stone or 6 inches of compacted select excavated material. This design will provide for a Type IV trench. However, the thickness design will be based on the contractor achieving only a Type II trench. A Type II trench situates the pipe on a flat bottom trench with lightly consolidated backfill to the centerline of the pipe.

This design criteria lessens dependency on the contractor's ability to compact the bedding and backfill materials, accounts for unforeseen instances where adequate compaction cannot be achieved, and accounts for situations where poor foundation soils require the pipe to function as a beam. The contract drawings will require the pipeline to be installed with a minimum earth cover of 5 feet.

3.7.5 Thrust restraint

Whenever a fitting is placed on the pipeline to change the direction of the alignment, a thrust force is created which must be restrained in order to prevent separation of the pipe joints. The two (2) thrust restraint methods available are concrete thrust blocks and restrained joint pipe. Due to the size of the pipe and anticipated test pressure for this project, the required thrust blocks would be quite large and cost prohibitive. In addition, the bearing capacity of certain types of soil may be such that thrust blocks are not feasible, such as in swampy lands or soils with high moisture content. For this project, restrained joint pipe is the most practical thrust

restraint method. The required length of restrained joint pipe on each side of fittings will be calculated for each size and type of fitting based on the required test pressure during the design phase of the project.

3.7.5.1 Ductile iron pipe

Ductile iron pipe joints for underground installation are typically bell and spigot push-on joints with a rubber gasket. Where joint restraint is required, manufacturers typically provide a boltless restrained joint system that mechanically locks the pipe together. Each manufacturer has a particular type of restrained joint design. For small adjustments of alignment in the field, 48-inch ductile iron pipe joints can be deflected up to 5 degrees for push-on joint sections and up to 1.5 degrees for restrained joint sections. Restrained joint ductile iron fittings are manufactured in standard sizes of 11.25-, 22.5-, 45-, and 90-degree bends.

3.7.5.2 Pre-stressed concrete cylinder pipe

Harnessed joints, which mechanically tie the joints together, are typically provided by the manufacturers for restrained joint sections. The type of harnessed joint varies according to the individual manufacturer's design. Similar to the bell and spigot type joints, PCCP restrained joint sections require field mortaring at the exposed metal joints.

3.7.5.3 Steel pipe

Restrained sections are normally constructed using field-welded lap joints, which require the additional labor of welding followed by field coating and lining of the joints.

In most field-welded lap joint installations, the joint is assembled bell over spigot. Lap-welded joints are configured for the application of a single fillet weld either on the outside or inside of the pipe. It is suggested that a non-destructive test of the field welds be completed using magnetic particle testing procedures and acceptance criteria as set forth in ANSI/AWS D.1.1, Section 6.14.5 Table 6.1.

3.7.6 Tapping connections

A criteria utilized in the evaluation of the alternate routes is the degree to which an alignment provides an opportunity for connections for potential future customers. It is not recommended that tees for future use be installed on the proposed rising main since there is a chance that they will not be used. Rather, future connections should be made by wet tapping. As such, the ease of making taps on the potential pipe materials is reviewed below.

3.7.6.1 Ductile iron pipe

Taps for flanged outlets on ductile iron pipe are completed using a tapping sleeve to which a tapping gate valve is bolted. A tapping machine is used to cut a disc from the pipe wall of the pipe while under pressure. The tapping saddle is installed on the ductile iron pipe utilizing mechanical joints.

Tapping ductile iron pipe can be completed by PWSA personnel depending on experience. Tapping machines may be purchased or rented with or without an operator.

3.7.6.2 Pre-stressed concrete cylinder pipe

Pressure taps for flanged outlets 3 inches and larger for PCCP are detailed in AWWA Manual M9. Flanged pressure taps are limited to the next smaller pipe diameter that is being tapped. A 48-inch diameter PCCP, the largest flanged pressure tap that can be installed would therefore be 30-inch diameter.

The general procedure used to install pressure taps for flanged outlets on PCCP is to first chip away the mortar coating where the tap is to be installed. A saddle is then positioned at the location of the chipped mortar coating and straps tightened around the pipe. The PCCP reinforcing wires are cut to provide clearance for the gland to seal against the steel pipe cylinder. A tapping valve or gate valve is attached to the gland flange and pressure-tested to confirm a watertight flange seal. A tapping machine is used to cut the steel cylinder of the pipe. The space between the saddle and gland is filled with grout, and a protective coating of cement-mortar is applied over the entire tapping assembly.

Tapping PCCP is a relatively routine procedure; however, a contractor specializing in PCCP tapping services is recommended for the diameter of the new rising main that is proposed.

3.7.6.3 Steel pipe

Taps for flanged outlets on steel pipe consist of installing a welded-on flanged outlet or a welded-on sleeve with flanged outlet. Upon installing the flanged outlet, a tapping valve or gate valve is installed and a tapping machine attached to drill the hole into the steel water main.

Similar to PCCP, tapping steel pipe is a relatively routine procedure; however, a contractor specializing in steel tapping services is recommended for the diameter of the rising main that is proposed. In addition, all welding should be done by qualified welders as required by AWWA C-200.

3.7.7 Appurtenances

3.7.7.1 Isolation valves

Isolating butterfly valves could be provided at key locations along the rising main to permit relatively small sections to be isolated and drained if necessary for repairs. The location and spacing of isolation valves should be considered during the design phase of the rising main. Two-inch corporations will be installed on both sides of the main line valves to permit chlorine to be added to the rising main and air to be expelled from the main during pressure testing. These corporations will be closed upon the completion of bacteriological testing.

3.7.7.2 Air release

Automatic air release, vacuum valve, and piping will be installed at high points along the rising main. A transient analysis of the pumps and rising main is recommended in sizing and locating combination air vacuum valves at strategic points along the alignment to protect the water rising main from vacuum conditions and cavitation.

3.7.7.3 Blow-offs

Manual blow-off lines will be provided at low points along the rising main. No fire hydrants will be connected to the rising main.

3.7.7.4 Access manways

Access manways will be provided along the rising main so as to provide for future access to the interior of the pipeline.

3.7.7.5 Leak detection devices

For sections of the rising main alignment where it will be difficult to determine if there is an active leak (i.e. water crossing), there is leak detection equipment available that may be considered for this project. Multi-channel data loggers can be utilized to record and communicate variables such as flow, leakage assessment, pressure, and pressure surges. A telemetry link can be provided either by landline telephone using an internal modem or by using cellular communications. Communication options also include direct cable to PDAs and laptop computers. The potential use of leak detection devices will be conducted during the design phase after the final pipeline alignment has been determined.

3.7.8 Corrosion control

A site-specific corrosivity study should be conducted when the final pipeline alignment is determined. However, preliminary indications are that at least some type of corrosion protection will be required for the rising main at certain locations.

3.7.8.1 Ductile iron pipe

Ductile iron pipe is subject to external corrosion. In the past, ductile iron pipe could be obtained with an external epoxy coating to protect the pipe from contact with corrosive soils. However, it is currently the practice of the ductile iron pipe manufacturers not to provide this coating. The corrosion protection recommended by the Ductile Iron Pipe Research Association (DIPRA) is encasement in polyethylene wrapping. As with most external coatings, this wrap is subject to damage during installation, which can be readily repaired. The application of field-installed wrap is more likely to suffer from quality control problems than coatings applied under controlled factory conditions. In unusually corrosive conditions, passive or active cathodic protection can be used on ductile iron pipelines. Bonding of the pipe joints to create a continuous path for current is also used as a corrosion protection measure.

3.7.8.2 Pre-stressed concrete cylinder pipe

In normal soil conditions, PCCP is protected from aggressive soils by the mortar coating that surrounds the pre-stressing wires and steel cylinder of the pipe. In special conditions where corrosion potential is great, PCCP can be provided with a factory-applied coal tar epoxy exterior coating or a cathodic protection system. A polyethylene wrap similar to ductile iron pipe can also be used and PCCP joints can also be bonded. There are also passive monitoring systems available for the use with PCCP, which "listen" for a snapped pre-stressed wire. The intent of these systems is to identify the location of a potential failure and allow the owner to make a repair to the pipe before a leak occurs.

3.7.8.3 Steel pipe

Corrosion protection for large steel mains is usually achieved through a factory-applied polyethylene tape coating or a factory-applied polyurethane external coating system. Tape coating systems are applied in accordance with AWWA C214. Polyurethane exterior coating systems are applied in accordance with AWWA C222. There is the potential for damaging either system during handling and installation, but damaged tape and coatings can be repaired in the field. Tape coatings are generally easier to detect damage and repair in the field than the

polyurethane coatings. Additional protection can be provided by buried sacrificial anodes or active current cathodic protection systems.

3.7.9 Trench restoration

After the rising main has been installed in the trench, the excavation must be backfilled with approved material. Proper bedding and backfilling is critical to distribute surface loads above the rising main. In addition, proper bedding and backfilling provides lateral support for the rising main to limit its movement due to thrust forces and surges (water hammer).

Depending on the soil conditions, the rising main will be bedded on either compacted select excavated material or quarry process stone. Trench backfill will be select excavated material, bank run sand and gravel or quarry process stone, depending on the applicable governing body requirements.

Where groundwater is encountered, clay stops will be constructed in the pipe trench at a spacing of 500 feet.

3.7.9.1 Ductile iron pipe

Laying conditions for ductile iron pipe must comply with ANSI/AWWA C150/A21.50. Five (5) standard laying conditions for ductile iron pipe (Type 1 through 5) provide flexibility for selecting the most appropriate pipe wall thickness.

A Type 1 trench, which consists of a flat bottom trench (undisturbed earth) with loose backfill, is not recommended for 36-inch through 48-inch pipe.

It is anticipated that if ductile iron pipe is used for this project, a detail specifying a Type 4 trench will be used. A Type 4 trench situates the pipe bedded in a 4-inch minimum layer of quarry-processed stone, with backfill compacted 80 percent to the top of pipe.

However, the thickness design will be based on the contractor achieving only a Type 2 trench. A Type 2 trench situates the pipe on a flat bottom trench with lightly consolidated backfill to the centerline of the pipe. This design criteria lessens dependency on the contractor's ability to compact the bedding and backfill materials, accounts for unforeseen instances where adequate compaction cannot be achieved, and accounts for situations where poor foundation soils require the pipe to function as a beam.

3.7.9.2 Pre-stressed concrete cylinder pipe

PCCP is considered to be a rigid pipe, and therefore, is less dependent upon the soil envelope for its strength and more forgiving to inadequate bedding or backfill. Pipe bedding and backfill for PCCP is detailed in ANSI/AWWA C304 and AWWA Manual M9. For PCCP diameters less than 72 inches, a Type R1 or R2 bedding condition is commonly used. Type R1 and R2 bedding conditions use a 30-dgree bedding angle and 45-degree bedding angle, respectively.

For Type R1 and R2 bedding conditions, the trench bottom should be over-excavated and bedding material extended to a depth of 4 inches below the bottom of the pipe if the trench bottom is rock or other unyielding material.

3.7.9.3 Steel pipe

AWWA Manual M11 states that the trench bottom should be excavated to a depth of a minimum of 2 inches below the grade line of the outside bottom of the pipe. The excess excavation should be filled with loose bedding material. The loose bedding material should be graded uniformly to the established grade line of the pipe.

Where the trench bottom includes solid or hard objects that can potentially penetrate or gouge the protective coating of the pipe, a bedding of crushed rock or sand 3 to 6-inches thick should be placed under the barrel of the pipe.

Pipe zone backfill height over the top of the pipe should be a minimum of 12 inches for diameters larger than 24 inches.

3.8 Comparison of alternative routes

The evaluation of Alternative Routes 1, 2, and 3 has been made based on the evaluation criteria and factors of importance described in Section 3.0 and with the design determinations made in Sections 3.3 through 3.7.

The primary factors for comparing alternatives are as follows:

- Constructability
- Redundancy and hydraulics
- Construction cost
- Complexity and risk of trenchless crossings
- Impacts to residents and business

As determined in the preceding sections of this report, the comparison of routes will be based on the following aspects of design:

- Construction Method: Open cut construction except at trenchless crossings.
- Trenchless Crossings:
  - Auger Boring at Trenchless Crossing No. 1
  - Auger Boring at Trenchless Crossing No. 2
  - Closed Faced Micro-Tunneling at Trenchless Crossings No. 3
- Depth of Pipe: 5-foot cover.
- Pipe Material: CL52 ductile iron pipe/welded steel pipe/pre-stressed concrete cylinder pipe
- Pipe Diameter: 48-inch diameter (open cut), 36-inch diameter (trenchless crossings), and 12-inch diameter connections to existing service connections (open cut).

3.8.1 Constructability of open cut segments

3.8.1.1 Alternative Route No. 1

Constructing Alternative Route No. 1 along the same alignment as the existing rising main will present many challenges. It is imperative that the existing rising main remain in service throughout the duration of construction. The primary constructability challenge related to Alternative Route No. 1 is the lack of available space adjacent to the existing rising main which would be required to install the new rising main. A secondary but related challenge is the inherent risk in excavating a new trench in close proximity to the existing main. It is the opinion of Mott MacDonald that Alternative Route No. 1 should be eliminated from consideration due to the limited available space needed for construction and the inherent risk of construction excavation adjacent to the existing rising main.

It is recommended that PWSA avoid having the proposed rising main installed within the same roads since having multiple mains in one road will not add a significant degree of reliability and redundancy.

3.8.1.2 Alternative Route No. 2

Constructing Alterative Route No. 2 along Freeport Road and Main Street will present many challenges related to traffic control, utility conflicts, ownership, and restoration. Freeport Road and Main Street are major thoroughfares in Aspinwall and Sharpsburg Boroughs. Open cut excavation in the right-of-ways is possible but would potentially require the closure of two (2) lanes of traffic and could necessitate major traffic control plans. In addition, Freeport Road is a PennDOT-owned roadway which could restrict PWSA's ownership and access for maintenance and could put PWSA at risk of having to relocate the water main in the future.

In consideration of these aspects of construction, Mott MacDonald considers Alternative Route No. 2 to be a constructible route and should remain in consideration as a viable new rising main alignment.

3.8.1.3 Alternative Route No. 3

Constructing Alterative Route No. 3 along local roadways within the boroughs will present many challenges related to construction access, utility conflicts, ownership, restoration, and impacts to residents. The primary challenge will be the impact that construction will have on homeowners and small businesses along the route coupled with the limited construction area within the right-of-ways. The roadways along Alternative Route No. 3 are narrow and are not in a grid pattern within Sharpsburg and Etna Boroughs. This will necessitate the use of shorter lengths of pipe with frequent changes in direction.

Moderate traffic control and construction notifications would be required along the local roadways. A moderate number of utility conflicts exist along Alternative Route No. 3.

In consideration of these aspects of construction, Mott MacDonald considers Alternative Route No. 3 to be a constructible route and should remain in consideration as a viable new rising main alignment.

3.8.2 Redundancy

Alternative Routes 2 and 3 both meet the primary objective in providing redundancy to the existing rising main system. Alternative Route 3 is situated further from the existing rising main system which will require additional piping in order to tie the new rising main into the existing system at the existing service connections. Alternative Route No. 2 is closer to the existing service connections which will require less piping to make connections.

3.8.3 Complexity and cost of trenchless crossings

As discussed in Section 3.5, both Alternative Route No. 2 and Alternative Route No. 3 include complex trenchless crossings at Trenchless Crossing No. 3 and, to a lesser extent, at Trenchless Crossing No. 2. Trenchless Crossing No. 1 is identical for Alternative Routes 2 and 3.

3.8.3.1 Alternative Route No. 2

Trenchless Crossing No. 2 – Alternative Route No. 2 would cross Trenchless Crossing No. 2 near the intersection of Freeport Road and the on/off ramps to the Highland Park Bridge in Aspinwall, with a total crossing length of approximately 500 feet. The total crossing may require two (2) separate trenchless installations to cross the entire width of PennDOT property and into Etna Borough. The Alternative 2 crossing of Trenchless Crossing No. 2 would require significant traffic routing and road closures possibly effecting the on and off ramps from Freeport Road to the bridge.

Trenchless Crossing No. 3 – Alternative Route No. 2 will require a minimum of two (2) and possibly three (3) trenchless crossing installations to cross Trenchless Crossing No. 3, with a total crossing length of approximately 815 feet. The first crossing would extend across PennDOT Highway 8. The second crossing would extend across Pine Creek, a CSX Rail line and PennDOT Highway 28. The second crossing may require two (2) separate crossing installations. Each of the trenchless crossings would require complex design evaluations due to the existence of shallow bedrock, soft soils, Pine Creek, and the highway piers.

3.8.3.2 Alternative Route No. 3

Trenchless Crossing No. 2 – Alternative Route No. 3 would cross Trenchless Crossing No. 2 near PennDOT 28 Exit 6 on ramp to the Highland Park Bridge, with a total crossing length of approximately 200 feet. The crossing will extend from the Aspinwall Community Park to an industrial park located on the western side of the Highland Park Bridge approach. Coordination with the borough would be required due to the need for construction activities in the park. An easement through the industrial park complex would be required.

Trenchless Crossing No. 3 – Alternative Route No. 3 can be accomplished with one (1) trenchless crossing extending across Trenchless Crossing No. 3, with a total crossing length of approximately 365 feet. The single crossing will extend across the Highway 8 and 28 interchange, Pine Creek, and a CSX Rail Line. The single crossing will require complex design evaluations due to the existence of shallow bedrock, soft soils, Pine Creek, and the highway piers.

Mott MacDonald believes the Alternative Route No. 3 trenchless crossings to be the most feasible options to cross property where open cut construction will not be permitted. The Alternative Route No. 3 trenchless crossings are less complex, would have less of a negative impact to the area, and are shorter in length in comparison to the Alternative Route No. 2 crossings.

3.8.4 Impacts during construction

The impacts to the residents and businesses in Aspinwall, Sharpsburg, Etna Boroughs, Shaler Township, as well as the surrounding communities, must be carefully weighed as this matter is an important aspect of the construction project. Design considerations including traffic control, construction notification, noise abatement, dust control, parking, and access to businesses and institutions will each need careful consideration.

Alternative Route No. 2 – The main impacts that would result from the construction of Alternative Route No. 2 is the control of traffic and the impacts to businesses along the route. Construction within the right-of-ways along Freeport Road and Main Street will have a major impact on traffic throughout the area and would require the use of alternative traffic routes along the local roads. Access to businesses, particularly in Sharpsburg and Etna Boroughs, would be considerably impacted.

Alternative Route No. 3 – The main impacts that would result from the construction of Alternative Route No. 3 is parking and access to local streets and homes along the route. Construction within borough right-of-ways will have local impacts requiring a greater amount of communication with residents, restricted working hours in residential areas, traffic and parking plans, and small borough-owned utility conflicts.

Alternative Route No. 2 will likely have a larger impact to the communities when compared to Alternative No. 3.

3.8.5 Cost estimates

Cost estimates have been prepared for the proposed rising main alignments in order to provide a quantitative analysis of the alternate routes. Detailed cost estimates are provided in Appendix E. The proposed rising main costs were calculated based on unit prices for material as quoted by pipe manufacturers within the last 60 days and from estimated labor costs for pipeline construction.

In order to perform a comparable evaluation of the cost of Alternative Routes 2 and 3 Mott MacDonald will utilize the per foot cost of ductile iron pipe in the costing estimate comparison. As previously stated Mott MacDonald recommends that the new rising main design considers the use of welded steel and pre-stressed concrete cylinder pipe, as well as ductile iron pipe, as appropriate pipe materials for the new rising main. As part of this report, unit price quotations were secured from local pipe representatives for ductile iron, steel, and PCCP pipe, as follows:

- Ductile iron pipe was quoted at $272/foot for 20-foot section of 48-inch, CL52, cement-lined, asphalt coated, non-restrained joint pipe and $370/foot for restrained joint pipe (including fittings and occasional blocking).
- Pre-stressed concrete cylinder pipe (PCCP) was quoted at $241 per linear foot for 48-inch diameter lined cylinder pipe with a 16-mil exterior coal tar epoxy. The unit price would need to be adjusted in consideration of restrained joined pipe, which would require harness clamp or snap-ring joints, which cost an average of $400 per joint or approximately $20 per foot of pipe.
- Welded steel pipe was quoted at $235 per linear foot for 20-foot sections of 48-inch diameter, class 200, cement lined, epoxy coated, welded steel pipe. While steel may have the lowest material cost, Mott MacDonald's experience in Western Pennsylvania has been that installation costs for steel pipe are less predictable than ductile iron or PCCP due to the added expense of welding for restrained joints and a smaller pool of contractors with familiarity in steel pipe installations.

In preparing estimates for pipeline installation, the following assumptions were made:

- Costs for the proposed rising main alignments were developed using ductile iron pipe as the pipe material. It has been assumed that 20 percent of the route would require restrained joint pipe.
- Pipe installation rates have been assumed to vary between 100 feet per day in more congested or difficult areas and 200 feet per day in less difficult areas. An average installation rate of 125 feet per day was utilized in the cost estimates.
- Backfill and bedding estimates assume 5 feet of cover throughout and to a depth of 0.5 feet below the invert of the new water main. This results in an excavation depth of approximately 10 feet.
- The proposed rising main would be provided with isolation valves, air valves, and blow-off assemblies at 2,500-foot spacing.
- Pipe installation within local roadways would require trench restoration with stabilized base followed by edge-to-edge paving.
- The unit costs utilized for the three (3) trenchless crossings were calculated from historical bid prices for various sized mains, discussions with pipeline contractors, and coordination with Mott MacDonald's pipelines group.
- All estimates for pipe installation include a 10 percent mark-up for contractor overhead, a 10 percent mark-up for profit, and a 30 percent mark-up for contingencies.

A total project estimate has been developed for each alternate route by adding assumed costs for permitting, easement acquisition, engineering, and other miscellaneous costs to the construction estimates. Permitting fees will need to be further refined during design stages. Proposed easements have been assumed to be a uniform 20 feet wide along any alternate alignment and were estimated at $5 per square foot. Easement costs will need to be further developed based on actual land value and preliminary negotiations with property owners. Engineering and other miscellaneous costs have been assumed at 10 percent of the estimated construction cost.

A *summary of estimated costs for each alternate alignment* is Appendix E. *Alternative Route* 3 represents the least costly alternative at $26.7 million while Alternative Route 2 is the more expensive alignment at $ 31.1 million.

4 Recommended route and summary

4.1 Recommended rising main route

Alternative Routes No. 2 and No. 3 are potentially feasible from a construction standpoint, and each alternate route appears to be permittable from a regulatory standpoint with no special requirements that would prevent or prohibit the selection. Section 3.0 of this report evaluates the potential alternate routes in terms of qualitative issues that were identified by Mott MacDonald and PWSA as being the primary factors for comparing the alternate alignments.

The estimated construction cost of Alternative Routes 2 and 3 are provided below.

- Alternate Route 2: $31,050,000
- Alternate Route 3: $26,662,000

Based on the factors evaluated in previous sections, MacDonald recommends that the new rising main follow the Alternative Route No. 3 alignment. The recommended route is shown in Figure 9. A majority of the route will be constructed utilizing open cut installation methods. Mott MacDonald believes that much of the route can be installed at a minimum depth with 5-foot of cover above the pipe crown. The three (3) trenchless crossings will be constructed using the following methods of trenchless technology:

- Auger Boring at Trenchless Crossing No. 1
- Auger Boring at Trenchless Crossing No. 2
- Closed Faced Micro-Tunneling at Trenchless Crossings No. 3

The final design of the new main will further evaluate the three (3) pipe materials; ductile iron, welded steel, and pre-stressed concrete cylinder pipe (PCCP), to determine which should be included in the final design package. It is recommended that at least two (2) pipe materials be included in the final design.

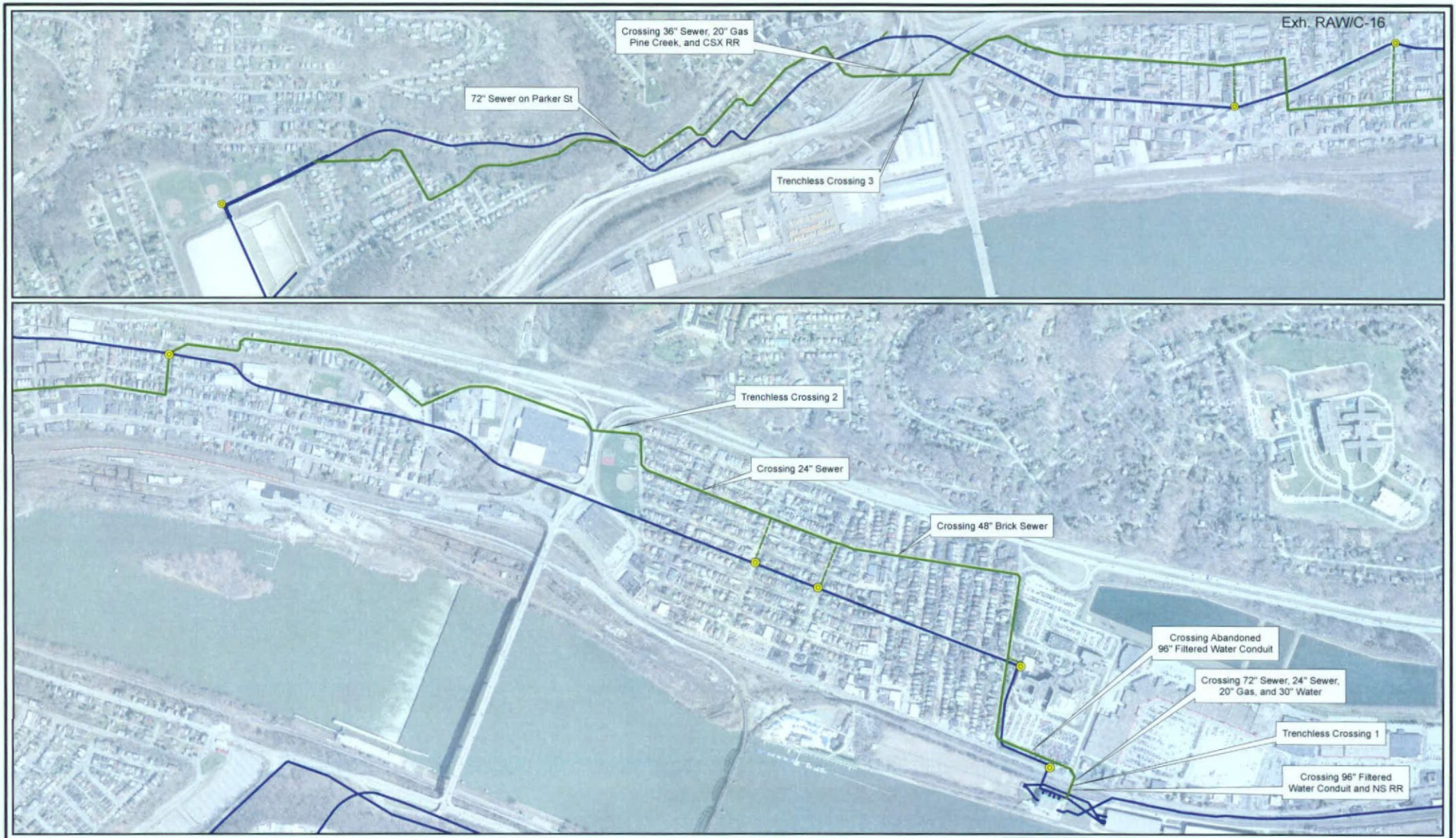
Based on the hydraulic analysis, the final alignment will be constructed using 48-inch diameter pipe on the open cut segments and 36-inch diameter pipe (installed with a 54-inch diameter steel casing) at the three (3) trenchless crossings.

A majority of Alternative Route No. 3 will be constructed within existing right-of-way in Aspinwall, Sharpsburg, and Etna Boroughs and Shaler Township. As part of the project's design phase, discussions and workshops with the governing bodies of each borough and township will be necessary to coordinate the construction effort and to further understand their needs.

Each trenchless crossing will require geotechnical investigations, as further described in Section 4.1.2 to further define below grade soil characteristics, depth to bedrock, and water table elevations.

It is recommended that the connection at the Aspinwall Pump Station be made off the eastern edge of the main discharge manifold as shown in Figure 10. As shown, the installation will require replacement of an isolation valve and temporary interruption of the emergency filter backwash pipe that extends to the WTP Filter Building. Trenchless Crossing No. 1 would commence at this location, requiring a jacking pit to be installed adjacent to the isolation valve.

Exh. RAW/C-16



Legend

- Service Connections
- Alignment 2 (Proposed Rising Main)
- Alignment 2 Crossover Connection
- Alignment 1 (Existing Rising Main)

0 500 1,000 Feet

PGH2O

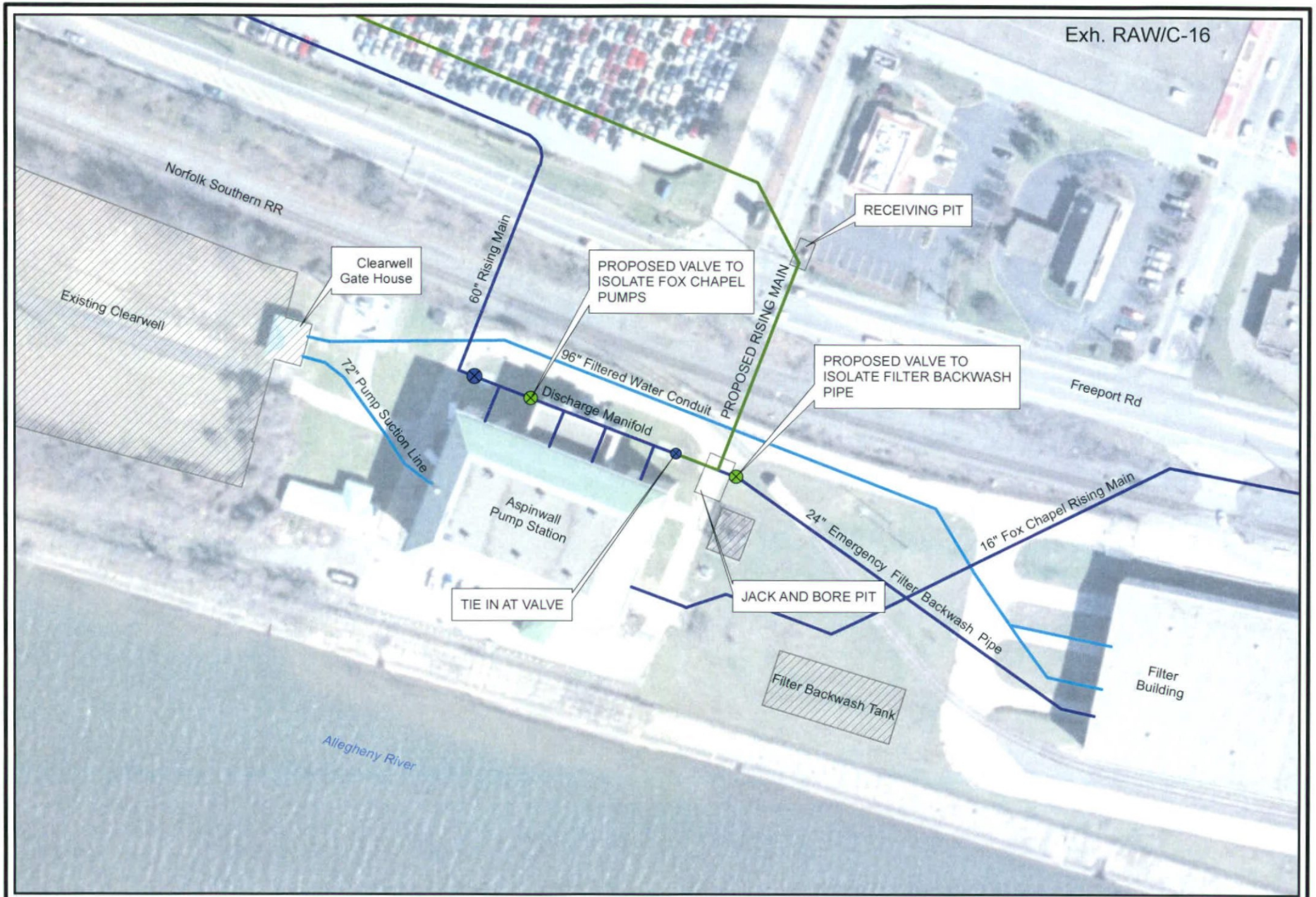
MOTT MACDONALD

1600 W Carson St.
Pittsburgh, PA 15219

PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 9 - RECOMMENDED RISING MAIN SYSTEM

Designed	Drawn	Checked	Approved	Date
	DWW			10/12/2016

Exh. RAW/C-16



Legend

Mainline Valves

- Closed
- Open
- Proposed Valves (closed)

0 100 200 Feet

Map Document: (C:\Users\wen74945\Documents\ArcGIS\PWSA\ChaosAt\AspinwallPumpStation(8.5x11).mxd)
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PGH2O

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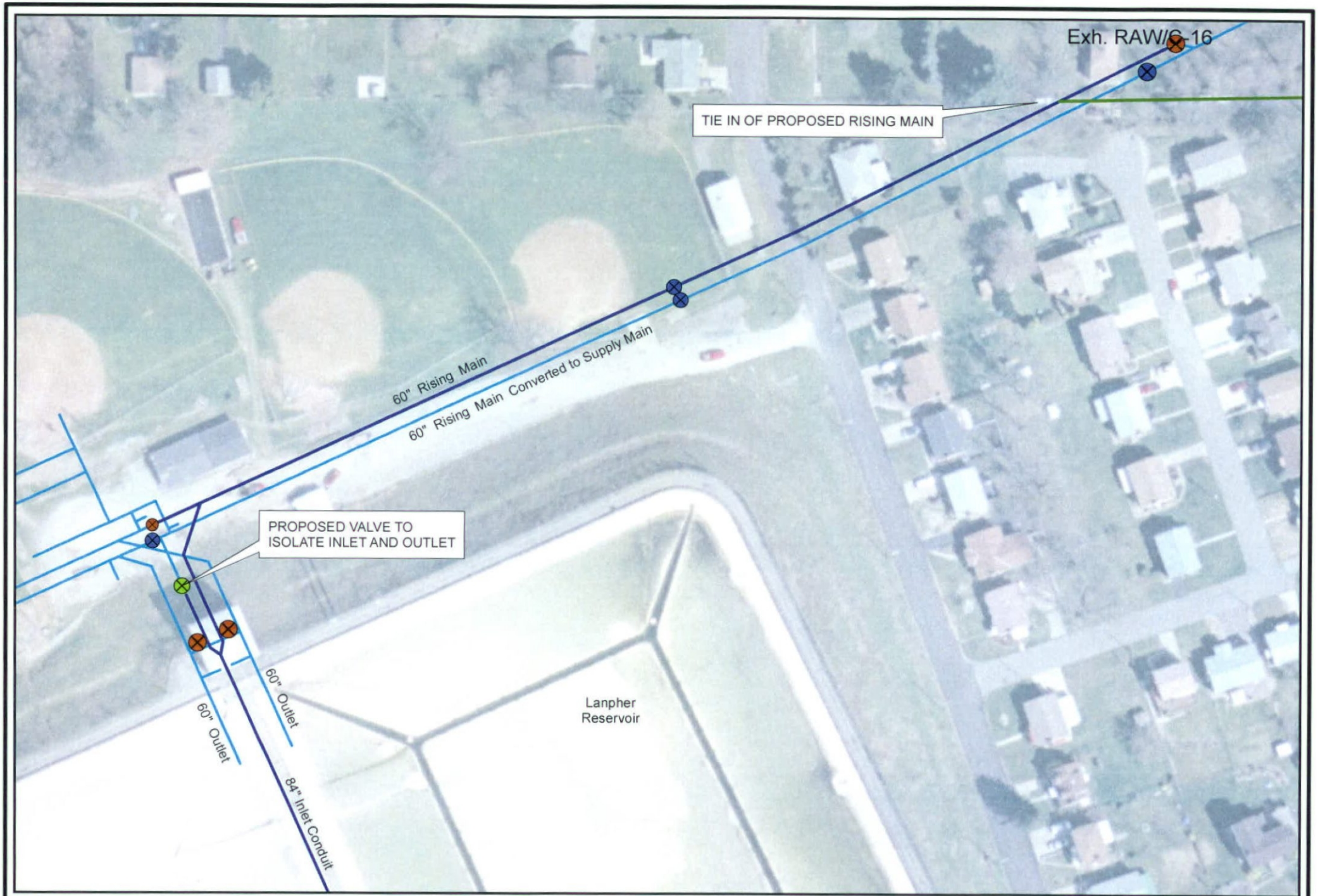
Pittsburgh, PA 15219

PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 9 - CONNECTION AT ASPINWALL PS

Designed	Drawn	Checked	Approved	Date
	DWW			3/9/2016

Exh. RAW/C-16



Legend

- Valve Closed
- Valve Open
- RisingMain
- SupplyMain

0 100 200 Feet

Map Document: (C:\Users\wen74945\Documents\ArcGIS\PWSA\PittsburghLanpher.mxd)
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PGH2O

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PITTSBURGH WATER AND SEWER AUTHORITY
PITTSBURGH, PA
LANPHER RISING MAIN
FIGURE 10 - CONNECTION AT LANPHER

Designed	Drawn	Checked	Approved	Date
	DWW			3/9/2016

Appendices

A. Rising Main repair history

Exh. RAW/C-16

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60" TRANSMISSION MAIN LINING UNDERGROUND PIPE REPAIR

Pittsburgh Water & Sewer Authority 2015-02-17



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Final Report

16 February 2015

Contractor:
HJ3 Infrastructure Group
Attn: Olley Scholer
2440 W Majestic Park Way
Tucson, AZ 85705

Client:
Pittsburgh Water & Sewer Authority
Attn: Rtunde Ibrahim
1200 Penn Avenue
Pittsburgh, PA 15222
Tel: 412.255.2545

Project:
2013-325-206-0 60" Transmission Main Lining Routes 8 & 28

Rtunde Ibrahim,
This report documents the full completion of this project. The completed project phases are summarized in table 1.1 and are detailed with notes and pictures later in the report.

If you have any questions then please feel free to contact me.

Sincerely,

Client Fulfillment Manager
HJ3 Composite Technologies

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Summary of Project Phases & Status

Project Phase	Status ✓= Complete X = Incomplete
Cement Paste Coating Removal	✓
Surface Profiling	✓
Surface Cleaning	✓
Surface Dry	✓
Crack Injection to Stop Water Infiltration	✓
Material Handling & Storage	✓
Carbon Fiber	✓
QC Inspection of Carbon Fiber	✓
QC Repairs of Carbon Fiber	✓
Adhesion Tests	✓
Top Coat	✓
Weko Seal Installation & Testing	✓
Client Walk-Through & Final Inspection	✓

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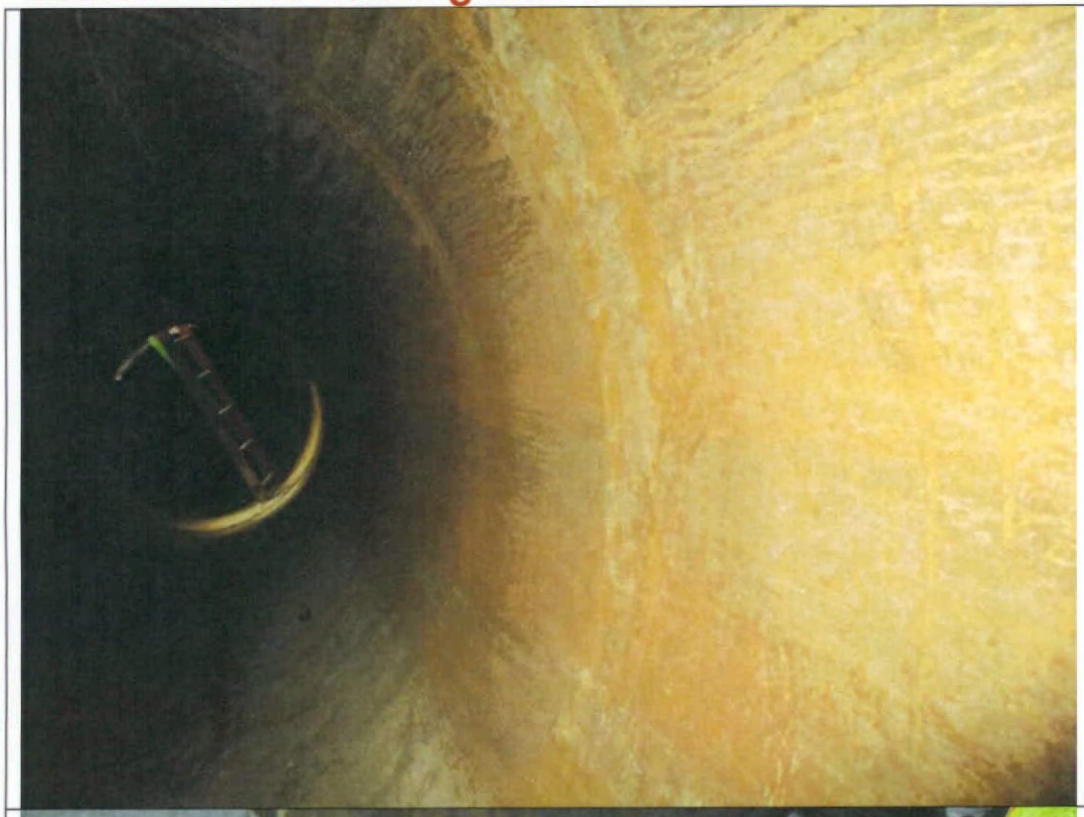
Cement Paste Coating Removal



Typical Cement Paste Coating

The Cement Paste Coating pictured at left was found on 100% of the pipe surface area.

The coating required full removal from the surface due to its weak compressive strength and insufficient bond strength to the cement mortar liner (CML) under a change order



Removal of Cement Paste Coating

HJ3 utilized lightweight demolition hammers to remove the cement paste coating from 100% of the pipe surface in the repair area.

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(Continued)



Removal of Cement Paste Spoils

The spoils from the cement paste coating removal were evacuated from the pipe and disposed of into HJ3's trash roll-off



Bare Cement Mortar Lining Exposed

100% of the cement paste coating was removed and the CML was exposed to complete the change order.

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Surface Profiling



Surface Profile

HJ3 verified surface profile to be a minimum of ICRI CSP #3 throughout the entire pipe

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Surface Cleaning



Surface Power Washed Clean

HJ3 power washed the surface to remove the extensive dust that had accumulated during the surface prep

The surface was washed multiple times and water was evacuated from the pipe

100% of the surface was vacuumed



Dust Test

HJ3 utilized a surface dust tester consisting of a coin wrapped in duct tape and randomly stuck to at least 5 locations

A pass is indicated by the dust test coin hanging to the surface under gravity and not falling off

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Surface Dry



Moisture Test

Multiple areas within a 20ft section of pipe was tested at random, with varying locations i.e.(top, bottom and sides)

The moisture was measured and was required to be 5% or less prior to applying primer coat

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Crack Injection to Stop Water Infiltration



Water Infiltration Inspection

21 locations from station 2+20 to approximately 3+20 were found to have active leaks allowing water infiltration

The water infiltration locations varied at the seams, top, bottom and sides of the pipe

A change order was required to stop the water infiltration



Crack Injection

HJ3 utilized a high pressure crack injection pump and sealant to inject the areas that were leaking

The crack injection required several injections over a 1.5 week time period to fully seal off the existing and new leak paths created during injection

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(Continued)



High Pressure Pumping

High pressures were utilized to force the low viscosity sealant into hollow cavities to seal off water infiltration



Surface Moisture Readings

Moisture readings were taken at all pump port locations to ensure that the concrete had less than a 5% moisture content

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Material Handling & Storage



Warehouse Storage

Polymers and Fabrics were stored in a warehouse prior to use

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Carbon Fiber



Installing Carbon Fiber

Carbon Fiber was installed over 100% of the repair area per the design

Scaffolding was utilized in the low sloping areas

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QC Inspection of Carbon Fiber

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Task: QC Inspection for CFRP

Results

1. QC Inspection performed
2. Assign Defect # and Record by Location
3. Assign Repair Procedure for Each

Tools & Equipment

- Paint Pen
- Hammer
- QC Inspection Log
- Measuring Wheel
- Tape Measure
- Measuring Rod

PPE

- Hard Hat
- Head Lamp
- Safety Glasses
- Dust Mask
- Long Sleeve Shirt
- Work Pants
- Steel Toe Boots

Steps

1. Inspect the HJ3 System for any voids or air encapsulation between the substrate and the layers of primer, resin and/or adhesive.
2. Inspect for any delamination between layers, damaged edges of the HJ3 System, or any wrinkling/buckling fibers.
3. Inspect for any discontinuities due to fracture of fibers, breaks in the fabric, or cracks in prefabricated material.
4. Inspect for any cracks, blisters or peeling of the surface coating.

QC Inspection Tasks

HJ3 Inspected 100% of the Repair Area for QC Anomalies including:

- Bubbles
- Voids
- Kinks
- Waves
- Dog-Ears
- Cuts
- Fins

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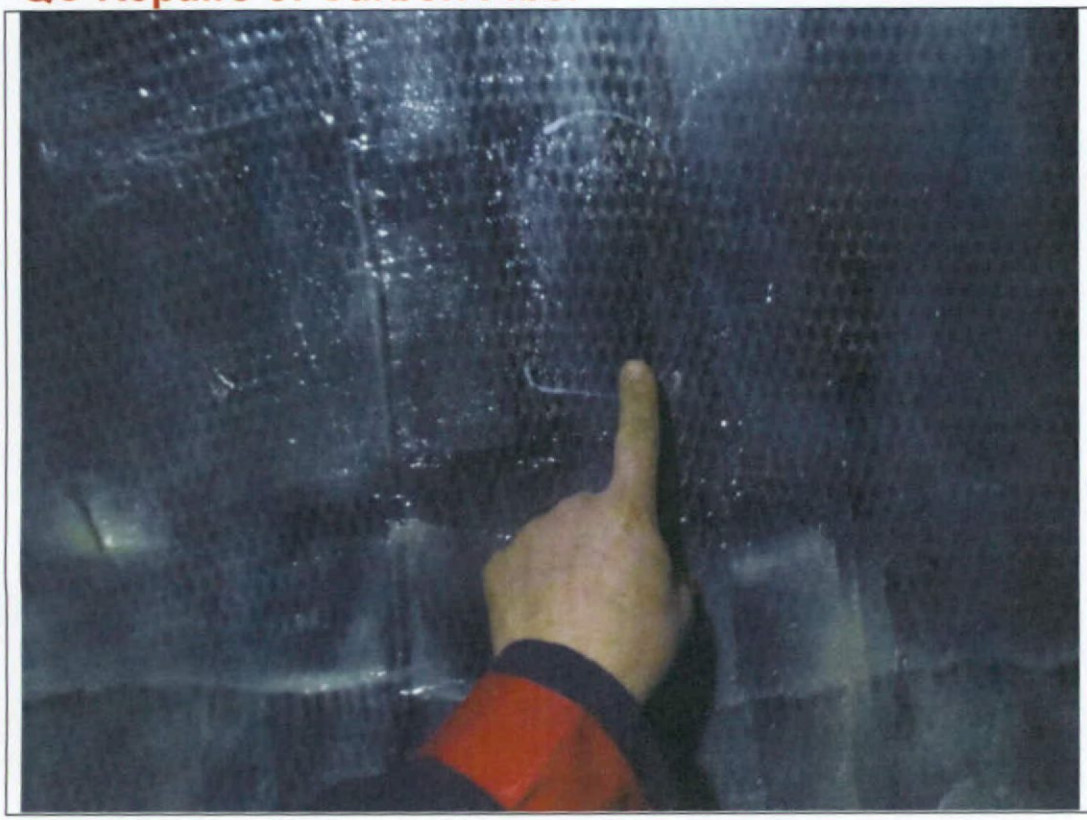
HJ3 Composite Technologies, L.L.C.
2440 West Majestic Park Way, Tucson, AZ 85705
520-322-0010 Toll-Free (US) 877-303-0453 Fax:520-322-0453
hj3.com info@hj3.com

CARBONSEAL™
INDUSTRIAL COMPOSITE SYSTEMS

QC Repairs of Carbon Fiber



QC Repairs

HJ3 Repaired the QC Anomalies including:

- Bubbles
- Voids
- Kinks
- Waves
- Dog-Ears
- Cuts
- Fins

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hj3.com info@hj3.com

Post-Installation Inspection of Carbon Fiber

Failure Modes from ASTM D7522

Failure Mode	Description
A	Bonding adhesive failure at loading fixture
B	Cohesive failure in FRP laminate
C	Adhesive failure at FRP/adhesive interface
D	Cohesive failure adhesive
E	Adhesive failure at FRP/concrete interface
F	Mixed Mode E and Mode G
G	Cohesive failure in concrete substrate

Bond Adhesion Testing

HJ3 Tested multiple areas per ASTM D4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"

The failure modes are expressed per ASTM D7522 "Standard Test Method for Pull-Off Strength for FRP Bonded to Concrete Substrate"

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Bond Adhesion Results

Location	Pull Test (psi)	Failure Mode
0+00	375	G
0+10	325	G
5+94	350	G
6+04	350	G

STATUS = PASS

- All adhesion tests > 200 psi required
- All adhesion tests had a Failure Mode "G" per ASTM D7522

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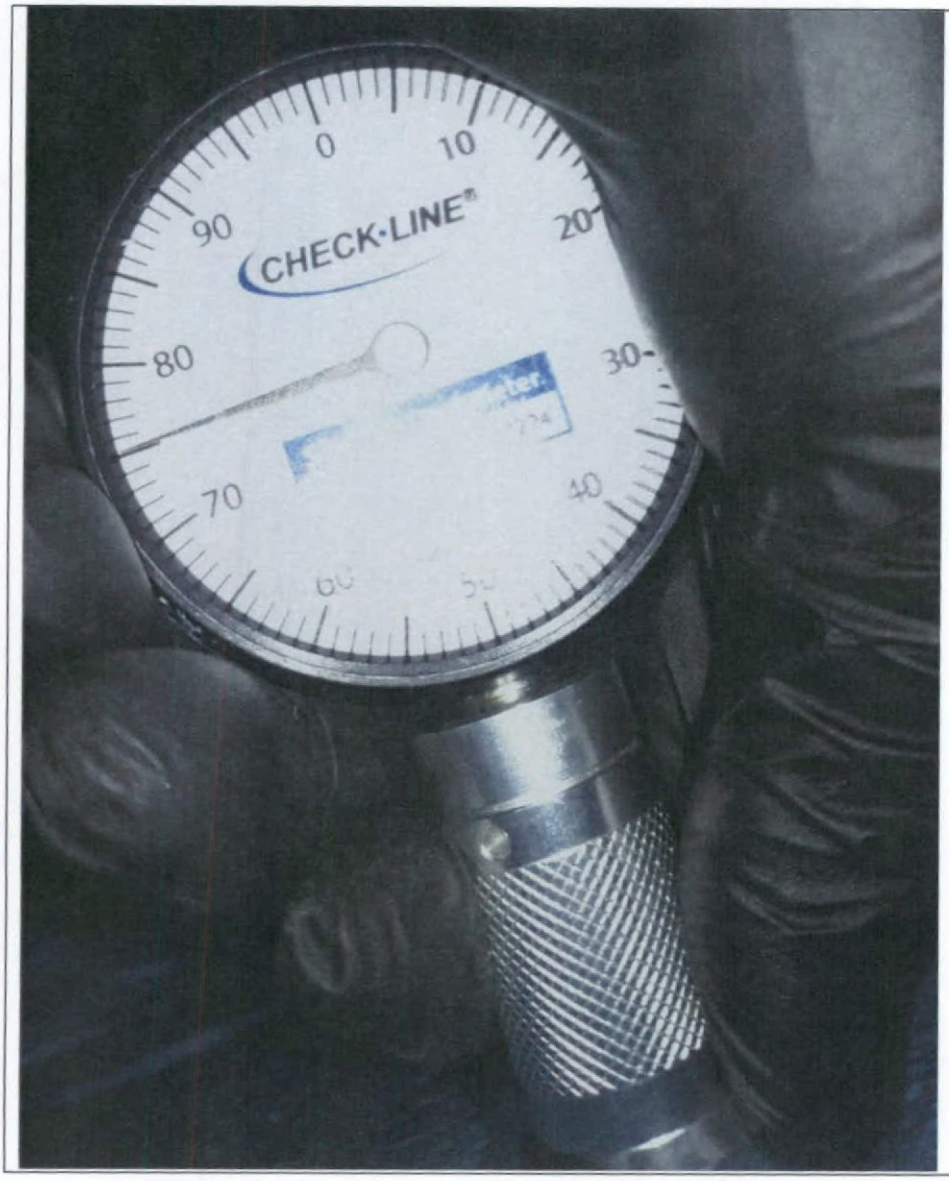
hj3.com info@hj3.com



Shore D Hardness Testing for Cure

HJ3 utilized a Shore D Hardness Gauge and followed the ASTM D2240 testing standard

The Shore D hardness reading is above 63 which is indicative of full cure.

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hj3.com info@hj3.com

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Top Coat



Top Coat Applied

Top Coat was applied to 100% of the carbon fiber surface of the pipe



Top Coat was applied to 100% of the carbon fiber surface of the pipe

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Termination Details - Weko Seal Installation & Testing



Weko Seal Expansion Ring

Steel bands were initially expanded, relaxed and then re-expanded to 4,500 psi



Steel bands were initially expanded, relaxed and then re-expanded to 4,500 psi

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(Continued)

	Final Weko in place

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hj3.com info@hj3.com

Client Walk-Through & Inspections

2/4/15

Client Walk-Through Inspection

Present:
Olley Scholer, HJ3
Joe Sparbanie, Chester Engineers, entered pipe
Anthony Teti, Pittsburgh Water & Sewer Authority, entered pipe
Rashed Tunde, Pittsburgh Water & Sewer Authority, did not enter pipe
John Waida, Pittsburgh Water & Sewer Authority, entered pipe

The pipe was inspected from end-to-end and was found to be a satisfactory installation.

2/11/15

Additional Inspection after Chlorination Overdose

Present:
Olley Scholer, HJ3
Joe Sparbanie, Chester Engineers, entered pipe
Anthony Teti, Pittsburgh Water & Sewer Authority, entered pipe
Rashed Tunde, Pittsburgh Water & Sewer Authority, did not enter pipe
John Waida, Pittsburgh Water & Sewer Authority, entered pipe

The pipe was reported to have received a straight dose of 12.5% Sodium Hypochlorite prior to the pipe being filled with water. The high concentration (125,000 ppm) was 2,500 times the target concentration of 50 ppm. HJ3 expressed concern to Chester Engineers and Pittsburgh Water & Sewer Authority that the carbon fiber liner has not been tested to handle the high chlorine concentration for the 24 hour duration that the liquid bleach had been left inside of the pipe un-diluted.

The pipe was re-inspected from end-to-end and based on a visual inspection there were no signs of apparent damage.

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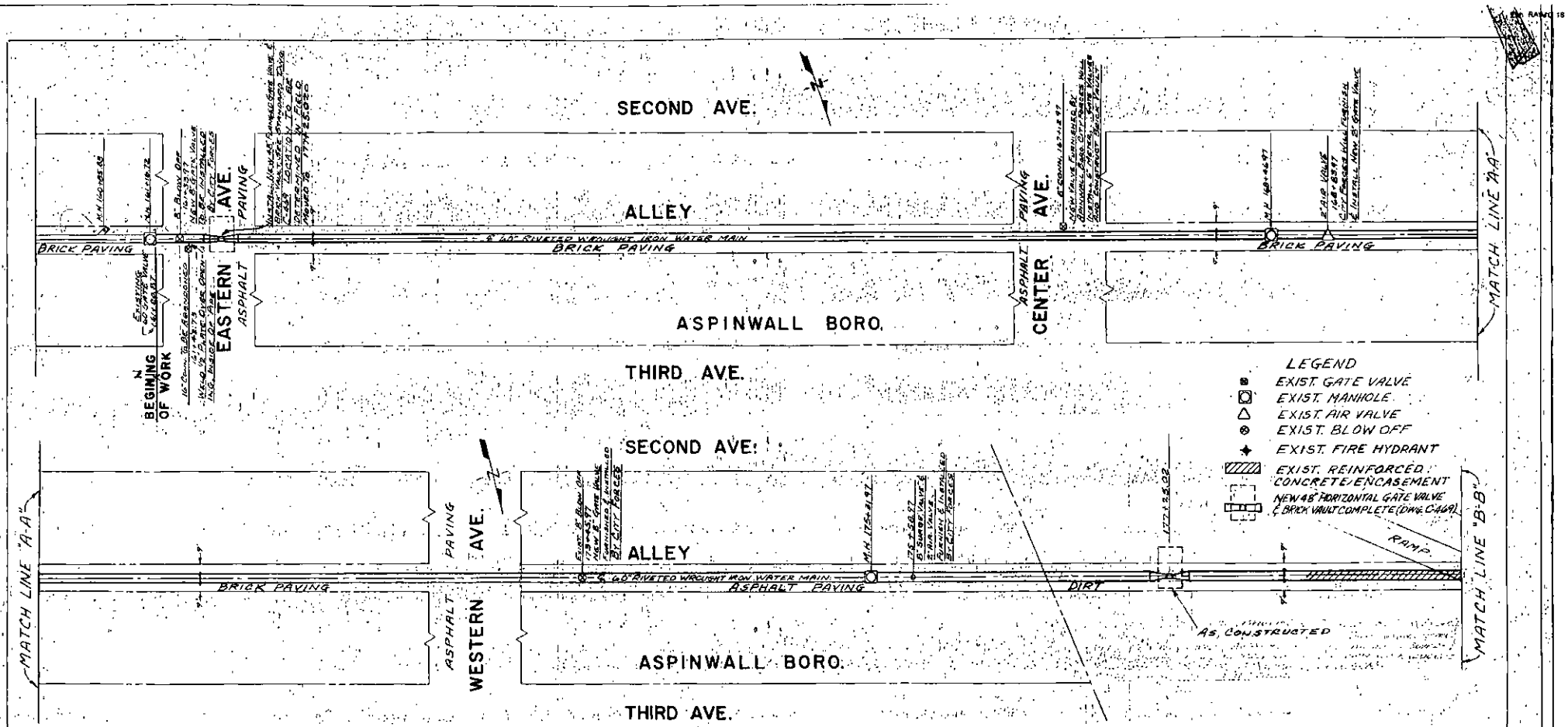
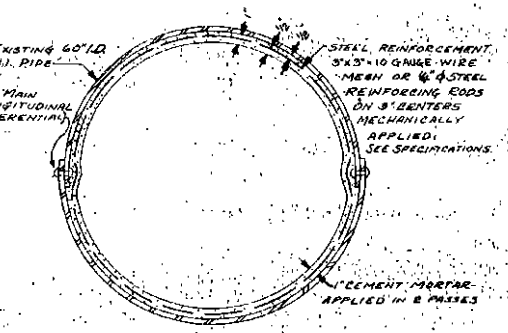
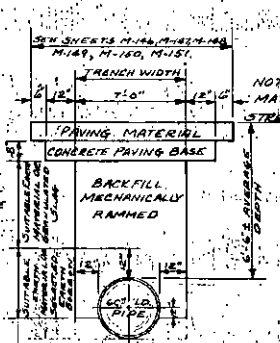




SECTION SHOWING REINFORCED CEMENT MORTAR LINING
NO SCALE

PLAN
SCALE 1" = 30'-0"



PAYMENT FOR SHAFT ACCESS OPENINGS, INCLUDING EXCAVATING, TRENCH COVER PLATES, TIMBER SUPPORTS, SHEETING & SHORING, HAULING, PROTECTING, BACKFILLING, CUTTING, REMOVING AND REPLACEMENT OF PIPE, AND APPURTENANCES, TO BE INCLUDED IN UNIT PRICE BID PER LINEAL FOOT OF CLEANING AND CEMENT MORTAR LINING OF STEEL WATER PIPE LINE, UNDER ITEM NO. ...

NOTE: STREET REPAVING SHALL MATCH EXISTING STREET SURFACING.

TYPICAL SECTION OF SHAFT AND REPAVING
NO SCALE

CONTRACT, ORDINANCE NO. 294 APPROVED JUNE 29, 1966
AMMENDED BY ORDINANCE NO. 221 APPROVED JUNE 12, 1967
CODE ACCOUNT (707 AND B.F. 204)
ESTIMATED COST $230,000.00
BOND REQUIRED $115,000.00
SPECIFICATIONS SPECIAL

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED
DIRECTOR DATE

DEPARTMENT NO. 1670
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

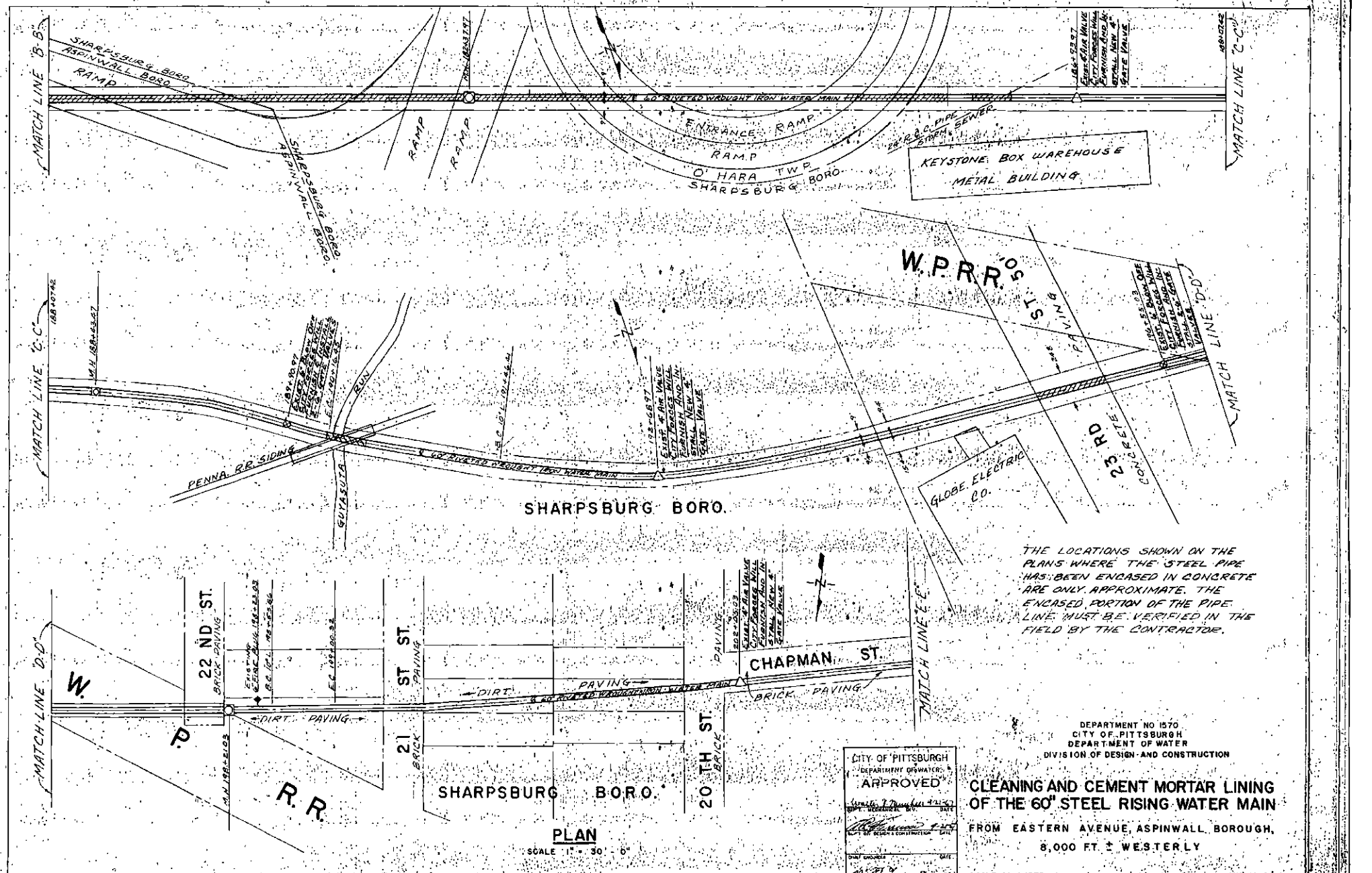
CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING WATER MAIN

FROM EASTERN AVENUE, ASPINWALL BOROUGH,
6,000 FT. ± WESTERLY

SCALE AS NOTED
JULY 1968
SHEET 1 OF 4 SHEETS

DR. BY R.D. EICHELMAN TR. BY R.D. EICHELMAN CKD. BY A.R.C.

WB-1233



PLAN

SCALE 1" = 30' - 0"

THE LOCATIONS SHOWN ON THE PLANS WHERE THE STEEL PIPE HAS BEEN ENCASED IN CONCRETE ARE ONLY APPROXIMATE. THE ENCASED PORTION OF THE PIPE LINE MUST BE VERIFIED IN THE FIELD BY THE CONTRACTOR.

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

DEPARTMENT NO 1570
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING WATER MAIN

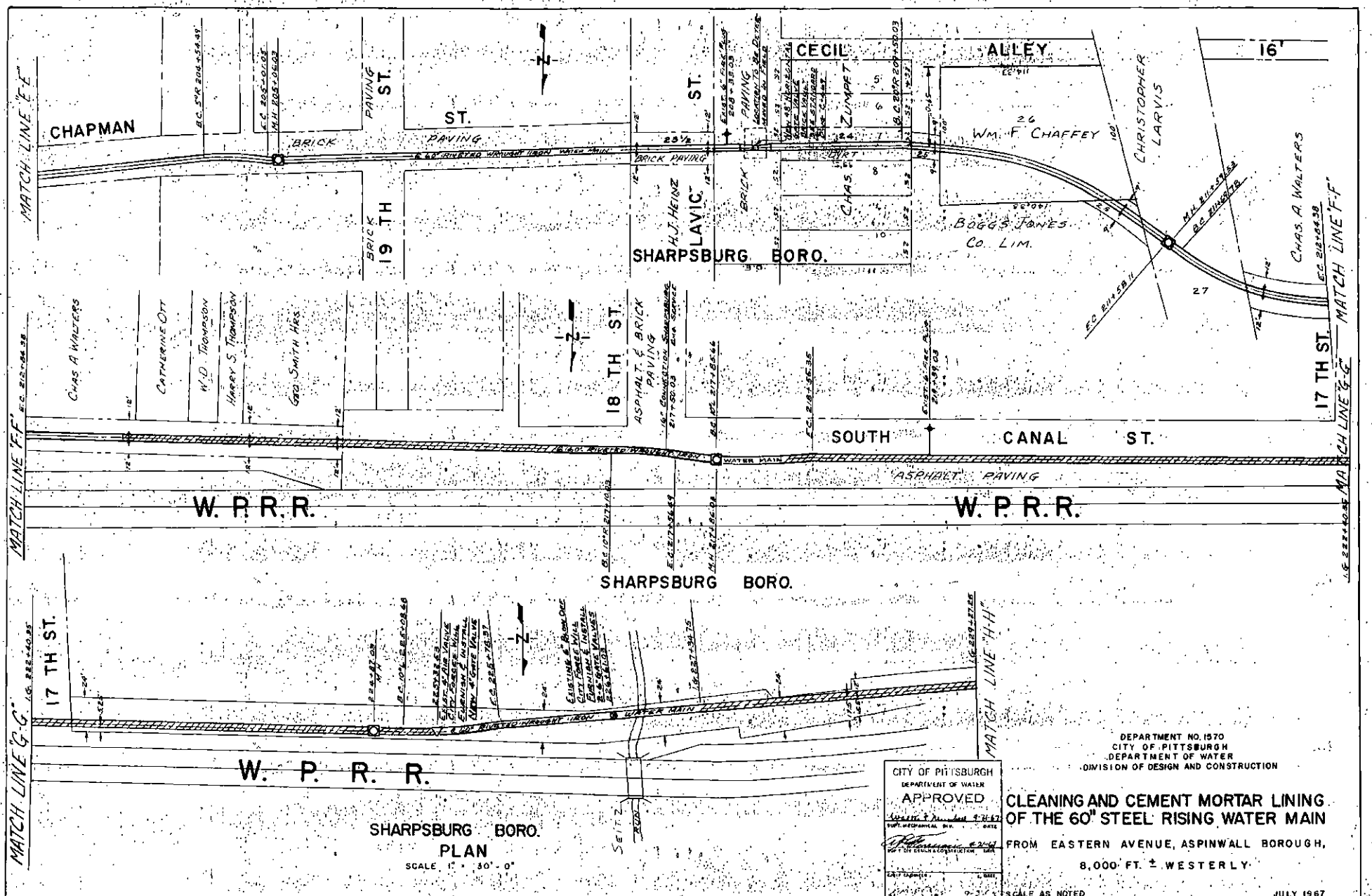
FROM EASTERN AVENUE, ASPINWALL BOROUGH, 8,000 FT. ± WESTERLY

SCALE AS NOTED — JULY 1964

SHEET 2 OF 4 SHEETS

DR. BY R.D.EICHELMAN * TR. BY R.D.EICHELMAN CKD BY J.R.E.

WB-1234



CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED
SUPT. MECHANICAL DIV. DATE
CHIEF ENGINEER
DIV'N OF DESIGN & CONSTRUCTION DATE
CHIEF ENGINEER
DIRECTOR DATE

DEPARTMENT NO. 1570
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING WATER MAIN

FROM EASTERN AVENUE, ASPINWALL BOROUGH, 8,000 FT. ± WESTERLY.

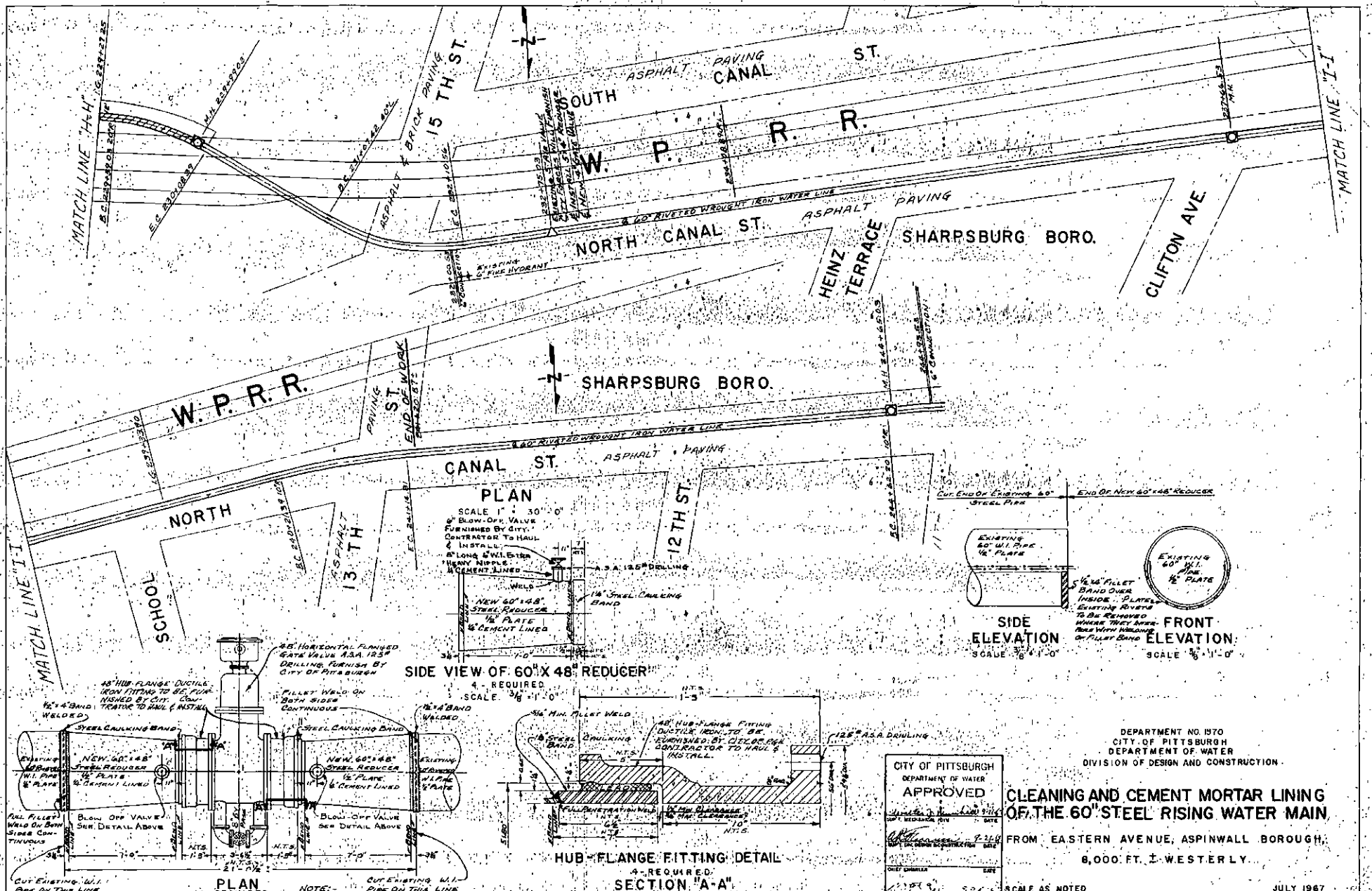
SCALE AS NOTED

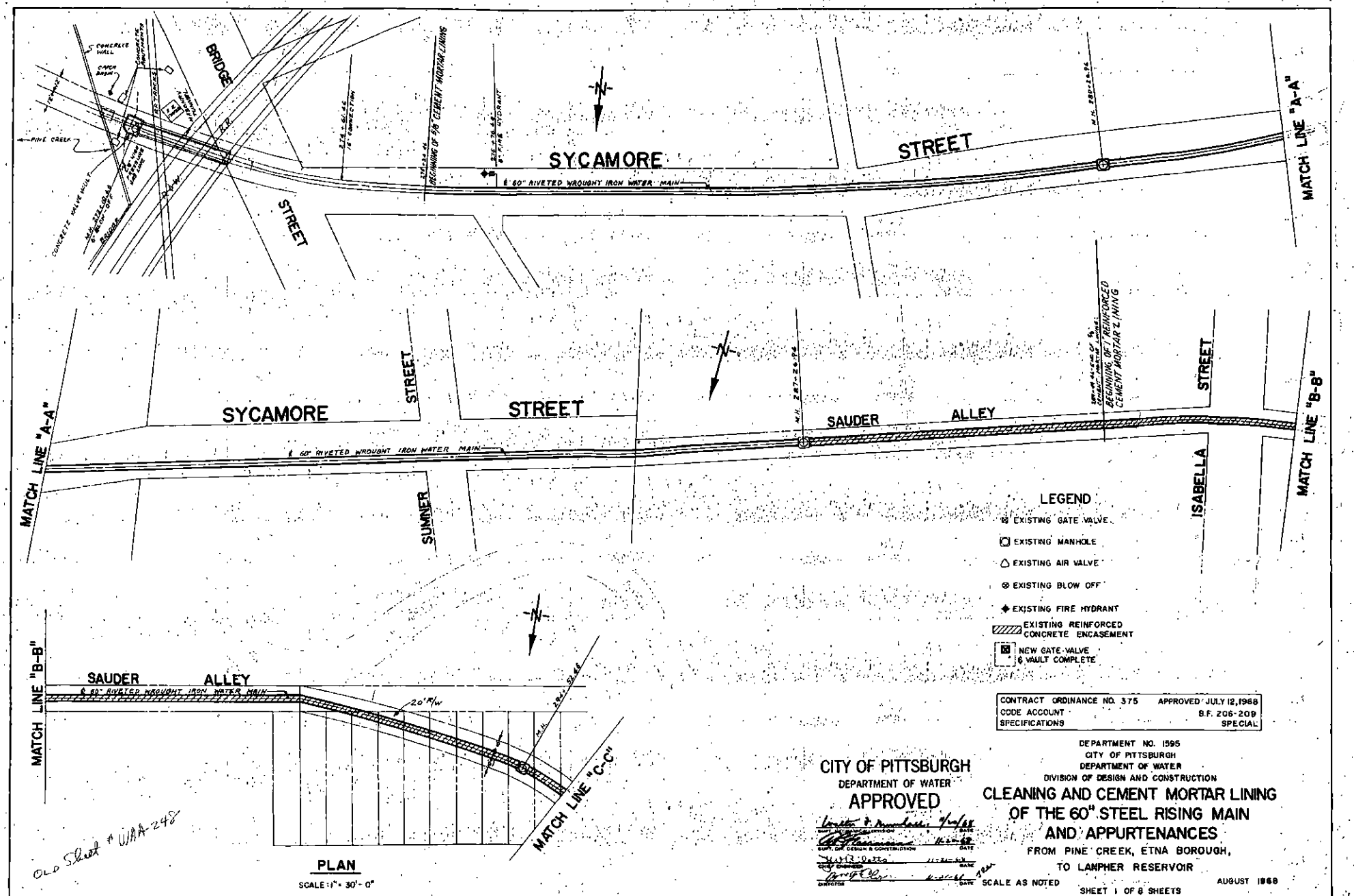
JULY 1967

SHEET 3 OF 4 SHEETS

DR. BY R.D. EICHELMAN TR. BY R.D. EICHELMAN CKD. BY A.P.E.

WB-1235


MATCH LINE "H-H"
MATCH LINE "I-I"
15 TH ST.
SOUTH CANAL ST.
ASPHALT PAVING
W. P. R. R.
60" RIVETED WROUGHT IRON WATER LINE
NORTH CANAL ST.
HEINZ TERRACE
SHARPSBURG BORO.
CLIFTON AVE
EXISTING 6" FIRE HYDRANT
W. P. R. R.
END OF WORK
SHARPSBURG BORO.
60" RIVETED WROUGHT IRON WATER LINE
CANAL ST.
ASPHALT PAVING
NORTH
SCHOOL
13 TH
12 TH ST.
MATCH LINE "I-I"
PLAN
SCALE 1" = 30'-0"
6" BLOW-OFF VALVE FURNISHED BY CITY. CONTRACTOR TO HAUL & INSTALL
6" LONG 6" W.I. EXTRA HEAVY NIPPLE
4" CEMENT LINED
WELD
NEW 60"x48" STEEL REDUCER
1/2" PLATE & CEMENT LINED
1/8" STEEL CAULKING BAND
A.S.A. 125# DRILLING
SIDE VIEW OF 60" X 48" REDUCER
4 - REQUIRED
SCALE 3/8" = 1'-0"
CUT END OF EXISTING 60" STEEL PIPE
END OF NEW 60"x48" REDUCER
EXISTING 60" W.I. PIPE 1/2" PLATE
5 1/2"x1/2" FILLET BAND OVER INSIDE PLATES. EXISTING RIVETS TO BE REMOVED WHERE THEY INTERFERE WITH WELDING OF FILLET BAND
SIDE ELEVATION
SCALE 3/8" = 1'-0"
EXISTING 60" W.I. PIPE 1/2" PLATE
FRONT ELEVATION
SCALE 3/8" = 1'-0"
48" HORIZONTAL FLANGED GATE VALVE A.S.A. 125# DRILLING, FURNISH BY CITY OF PITTSBURGH
48" HUB-FLANGE DUCTILE IRON FITTING TO BE FURNISHED BY CITY. CONTRACTOR TO HAUL & INSTALL
FILLET WELD ON BOTH SIDES CONTINUOUS
1/2"x4" BAND WELDED
STEEL CAULKING BAND
EXISTING 60" W.I. PIPE 1/2" PLATE
NEW 60"x48" STEEL REDUCER
1/2" PLATE & CEMENT LINED
ALL FILLET WELD ON BOTH SIDES CONTINUOUS
BLOW OFF VALVE SEE DETAIL ABOVE
CUT EXISTING W.I. PIPE ON THIS LINE
PLAN
2 - REQUIRED
SCALE 3/8" = 1'-0"
NOTES:- THE EXTERIOR SURFACES OF ALL STEEL PLATE REDUCERS TO BE COATED WITH REINF'T. BITUMINOUS
5/16" MIN. FILLET WELD
1/8" STEEL CAULKING BAND
48" HUB-FLANGE FITTING DUCTILE IRON, TO BE FURNISHED BY CITY OR P&E CONTRACTOR TO HAUL & INSTALL
125# A.S.A. DRILLING
FULL PENETRATION WELD
HUB-FLANGE FITTING DETAIL
4 - REQUIRED
SECTION "A-A"
SCALE 3" = 1'-0"
CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED
SUPT. MECHANICAL DIV.
DATE
CHIEF ENGINEER
DIRECTOR
DEPARTMENT NO. 1970
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION
CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING WATER MAIN
FROM EASTERN AVENUE, ASPINWALL BOROUGH,
6,000 FT. ± WESTERLY.
SCALE AS NOTED
JULY 1967
SHEET 4 OF 4 SHEETS
DR. BY R.D. EICHELMAN TR. BY R.D. EICHELMAN CKD. BY A.R.F.
WB-1236



CONTRACT ORDINANCE NO. 375	APPROVED JULY 12, 1968
CODE ACCOUNT	B.F. 206-209
SPECIFICATIONS	SPECIAL

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

FROM PINE CREEK, ETNA BOROUGH, TO LANPHER RESERVOIR

SCALE AS NOTED

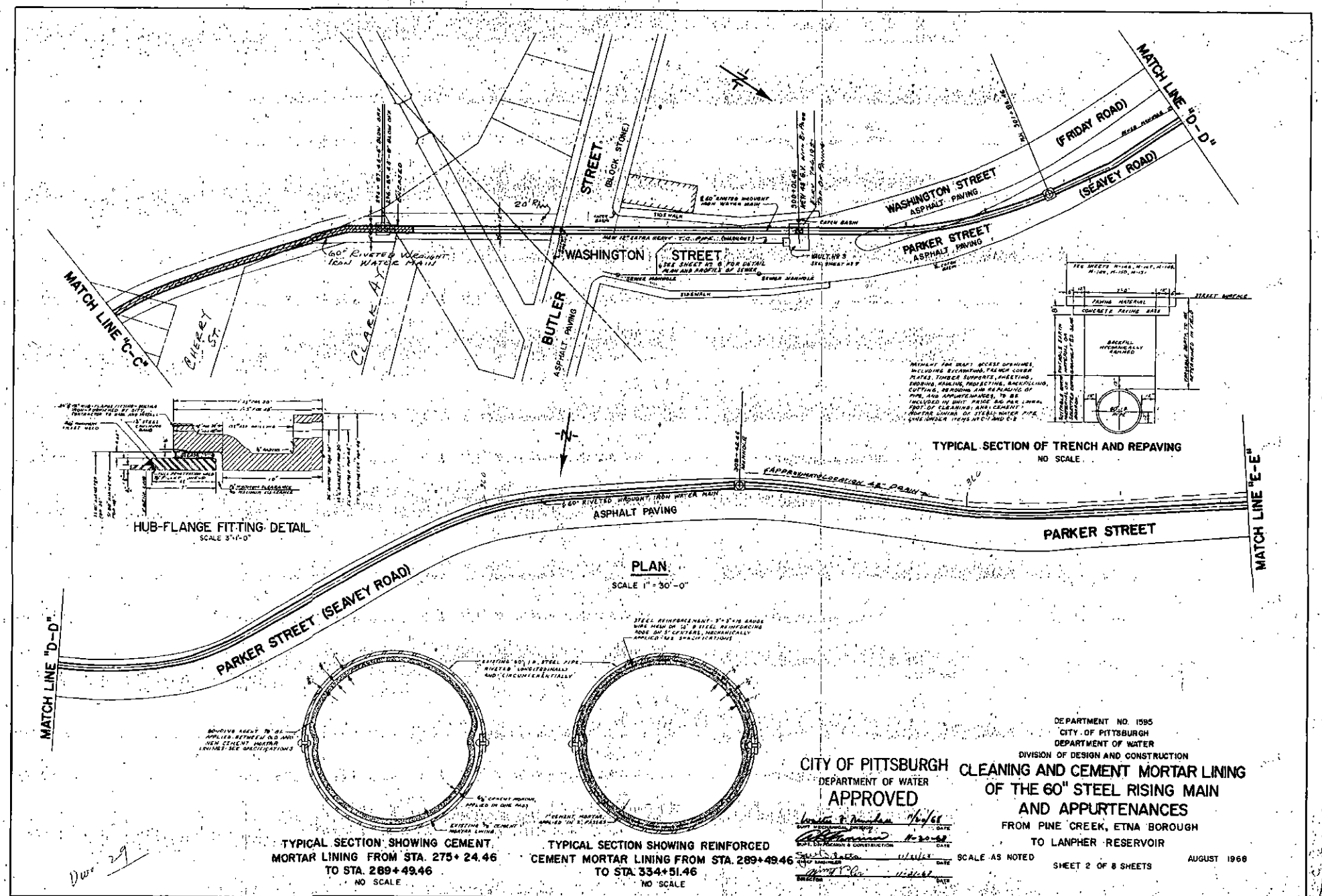
AUGUST 1968

SHEET 1 OF 8 SHEETS

DR. BY R.D. EICHELMAN TR. BY W.H. HENSTOCK CKD. BY A.R.F.

CALC. BOOK A2?? PG 1-2

WB-1269



TYPICAL SECTION SHOWING CEMENT MORTAR LINING FROM STA. 275+24.46 TO STA. 289+49.46
NO SCALE

TYPICAL SECTION SHOWING REINFORCED CEMENT MORTAR LINING FROM STA. 289+49.46 TO STA. 334+51.46
NO SCALE

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

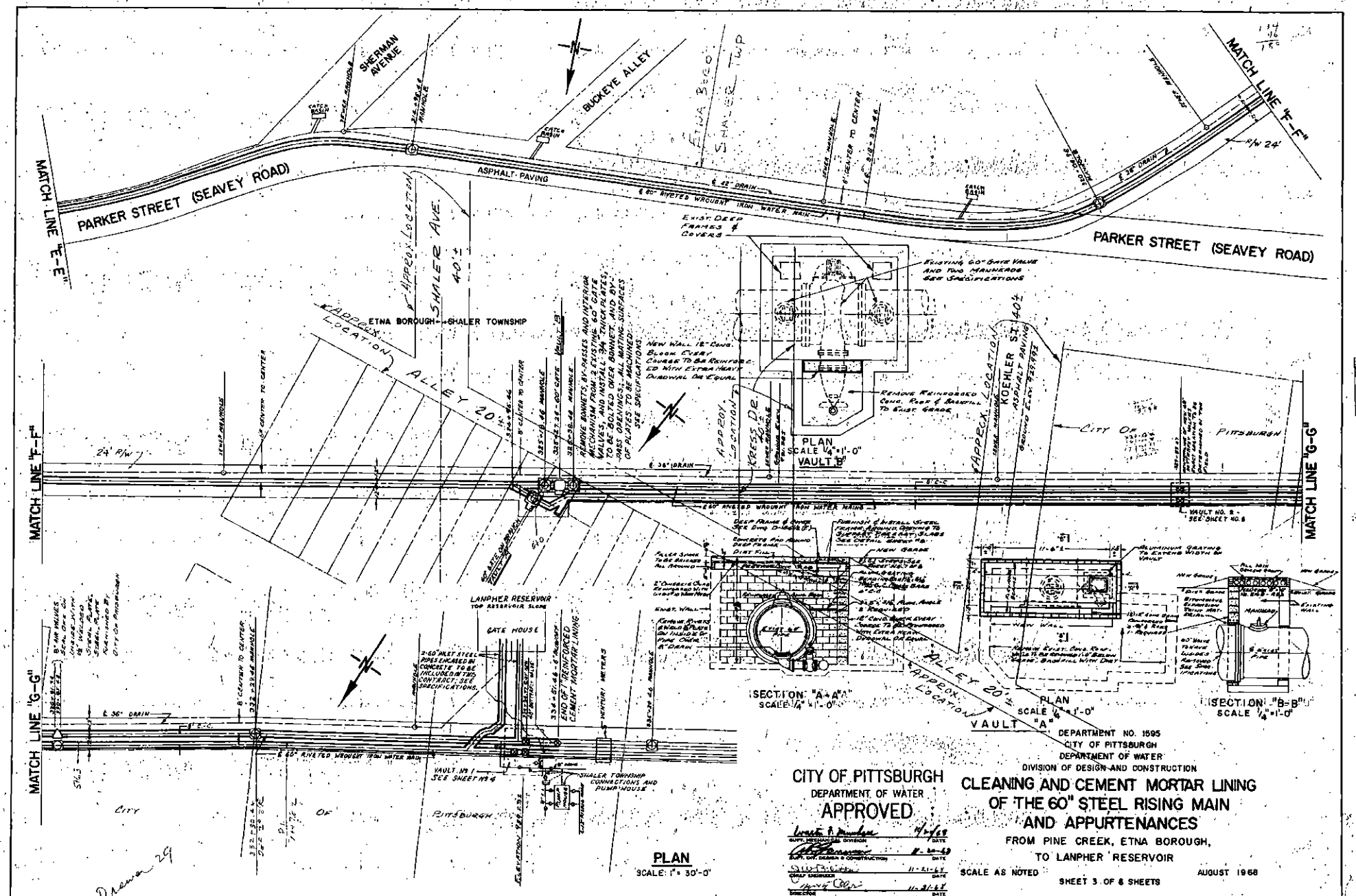
CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

FROM PINE CREEK, ETNA BOROUGH
TO LANPHER RESERVOIR

SCALE AS NOTED
AUGUST 1968
SHEET 2 OF 8 SHEETS

DR. BY R.D. EICHELMAN TR. BY W.H. HENSTOCK CKD. BY A.R.F.

W.B-1270



CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

SUPT. MECHANICAL DIVISION	DATE 11-21-69
SUPT. DIV. DESIGN & CONSTRUCTION	DATE 11-21-69
CHIEF ENGINEER	DATE 11-21-69
DIRECTOR	DATE 11-21-69

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

FROM PINE CREEK, ETNA BOROUGH,
TO LANPHER RESERVOIR

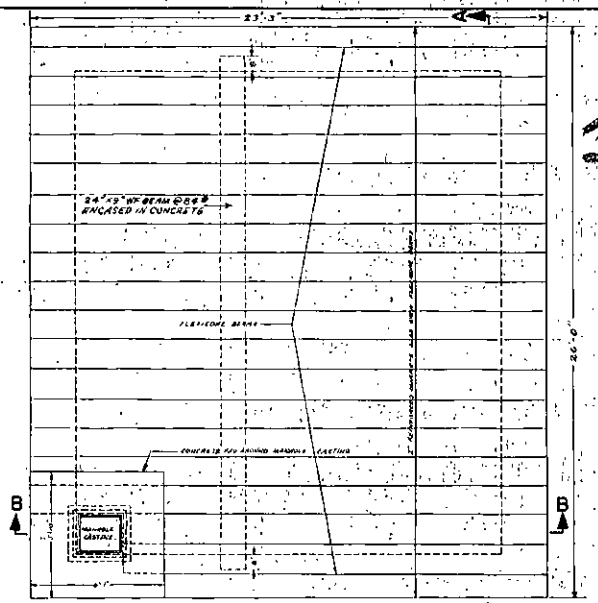
SCALE AS NOTED — AUGUST 1968

SHEET 3 OF 6 SHEETS

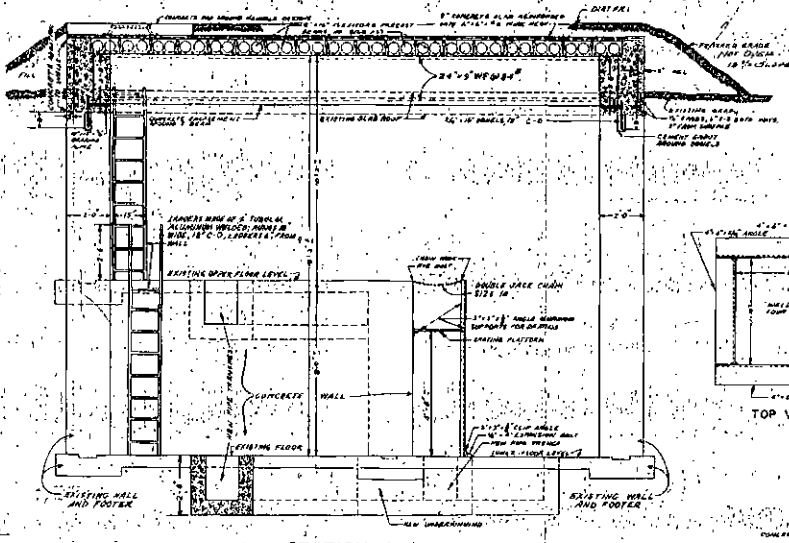
DR. BY R.D EICHELMAN . TR. BY W.H HENSTOCK CKD. BY A.R.F.

CALC. BOOK A218 PG. 3-4

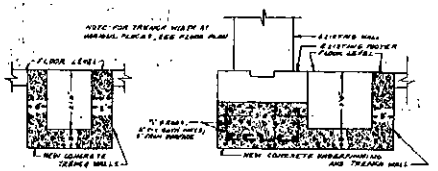
WB-1271



ROOF PLAN
SCALE 1/8"=1'-0"

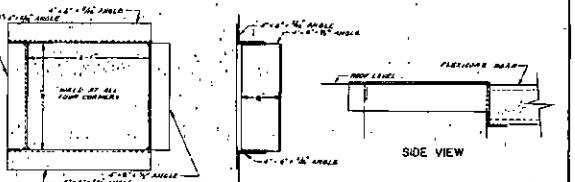


SECTION A-A
SCALE 3/8"=1'-0"



TYPICAL SECTION C-C
SCALE 1/2"=1'-0"

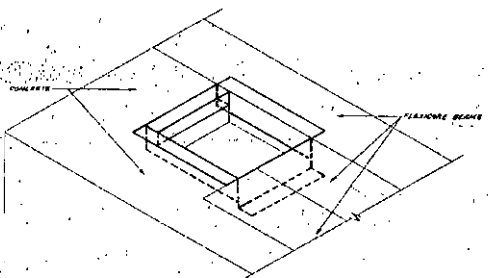
TYPICAL SECTION D-D
SCALE 1/2"=1'-0"



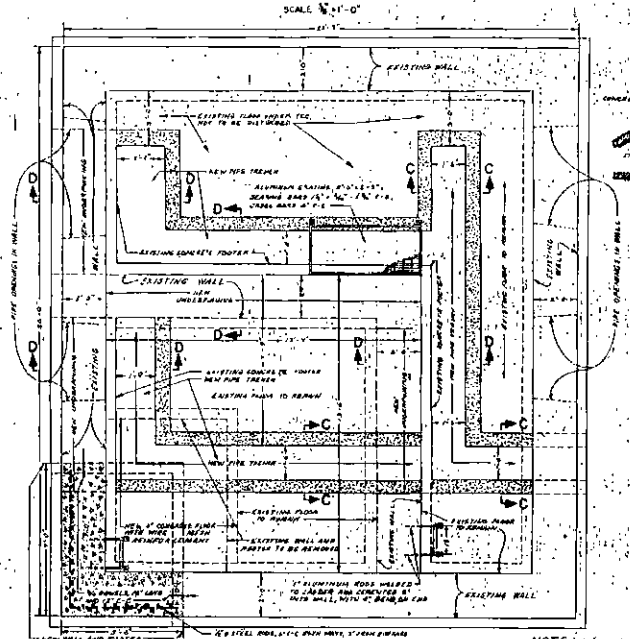
TOP VIEW

END VIEW
SCALE 1"=1'-0"

SIDE VIEW

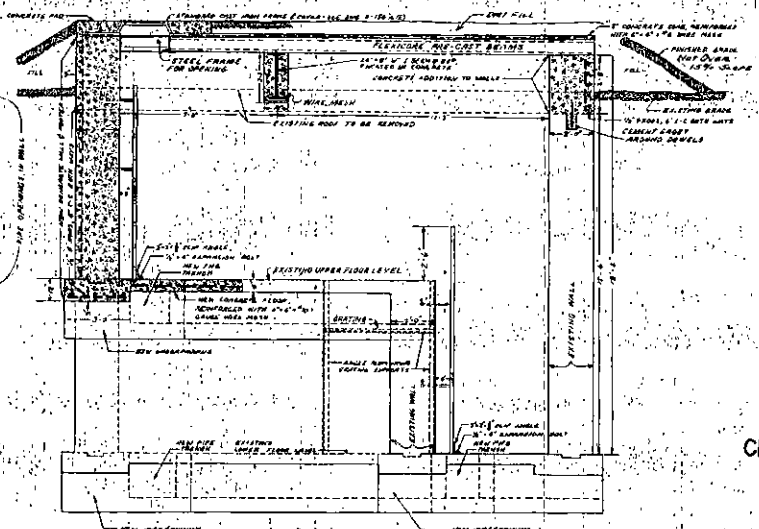


DETAIL OF STEEL FRAME OPENING
SCALE 3/8"=1'-0"



FLOOR PLAN
SCALE 3/8"=1'-0"

NOTE
Contractor to verify all dimensions shown on this drawing in the field.



SECTION B-B
SCALE 3/8"=1'-0"

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

DEPUTY, MECHANICAL DIVISION — DATE 11/20/68
CHIEF, DIV. OF DESIGN & CONSTRUCTION — DATE 11-21-68
CHIEF ENGINEER — DATE 11-21-68
DIRECTOR — DATE 11-21-68

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

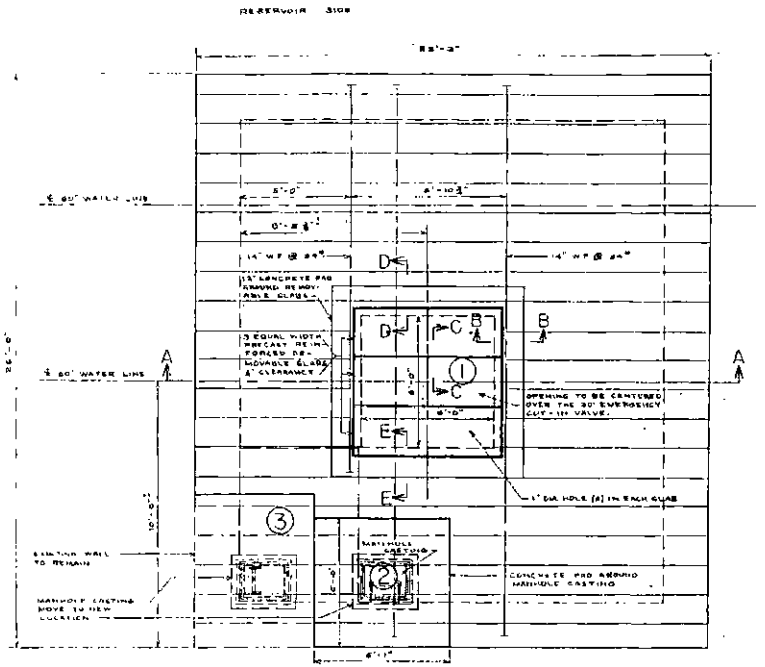
CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

FROM PINE CREEK, ETNA BOROUGH,
TO LANPHER RESERVOIR;
RECONSTRUCTION OF VAULT NO. 1

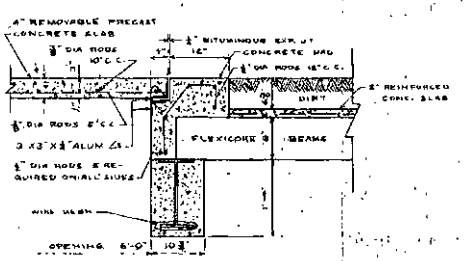
SCALE AS NOTED — SHEET 4 OF 8 SHEETS — AUGUST 1968

DR. BY W.H. HENSTOCK TR. BY W.H. HENSTOCK CKD. BY A.R.F.

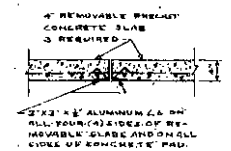
W B-1272



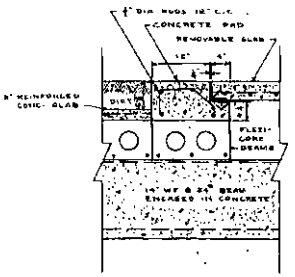
PLAN OF VAULT ROOF
SCALE: 3/8" = 1'-0"



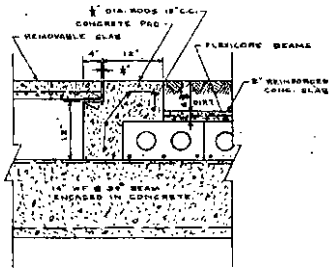
SECTION B-B
SCALE: 1"=1'-0"



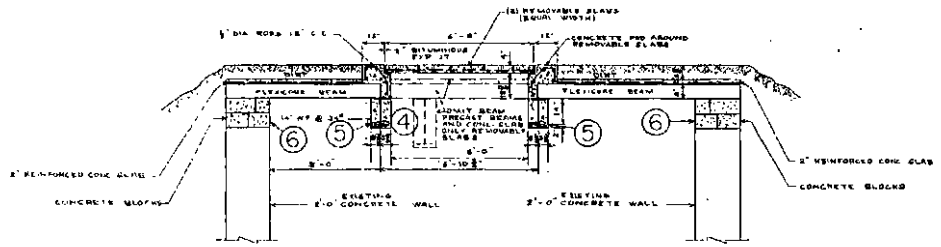
SECTION C-C
SCALE: 1"=1'-0"



SECTION E-E
SCALE: 1"=1'-0"



SECTION D-D
SCALE: 1"=1'-0"



SECTION A-A
SCALE: 3/8"=1'-0"

REVISED

1. NEW ROOF VAULT OPENING
2. RELOCATING ACCESS MANHOLE AND LADDER
3. OMIT CORNER WALLS
4. OMIT EXISTING BEAM
5. NEW BEAMS
6. CONCRETE BLOCKS

NOTE: FLEXICORE FRAMING OVER VAULT NO. 1
SEE FLEXICORE DRAWING NO. 969-1
REVISED MAY 13, 1969

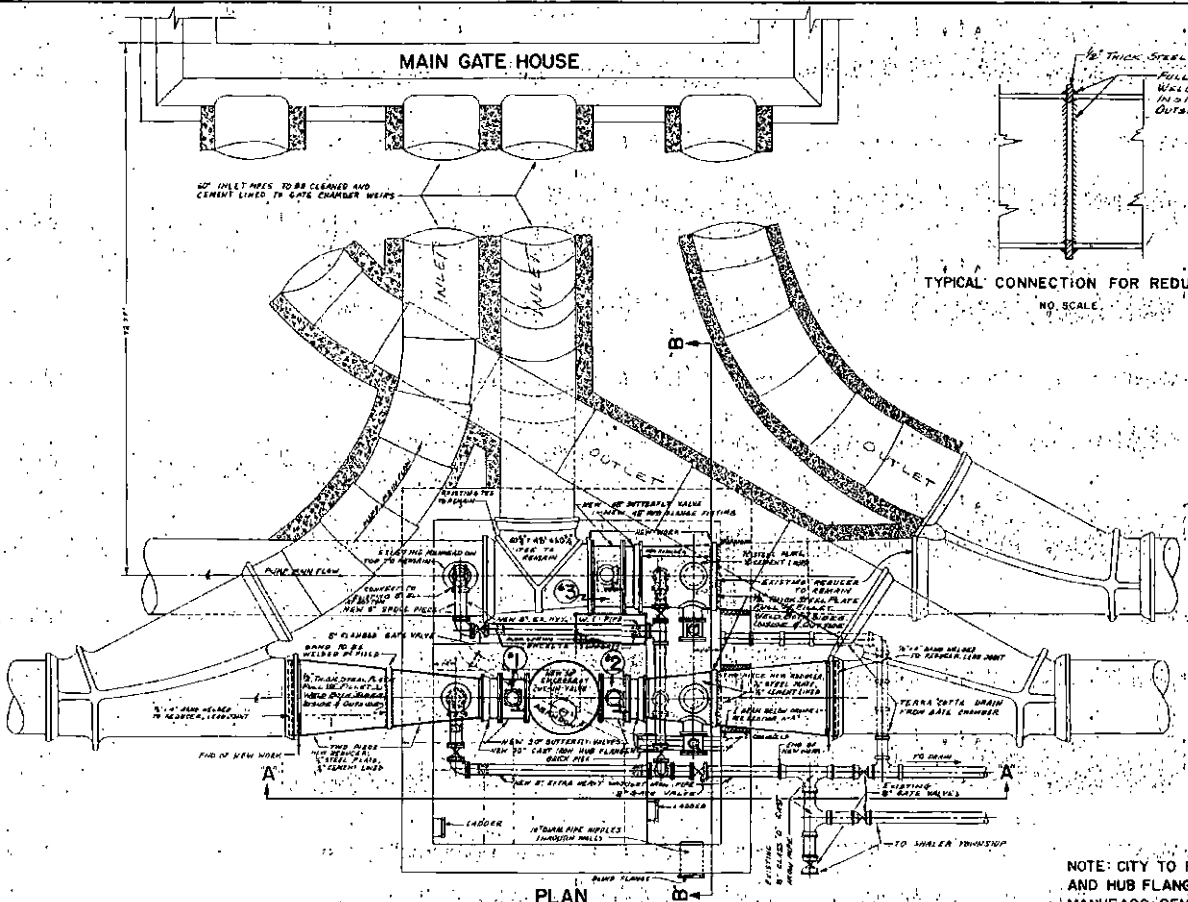
CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES
FROM PINE CREEK, ETNA BOROUGH, TO LANPHER RESERVOIR
RECONSTRUCTION OF VAULT NO. 1
REVISED

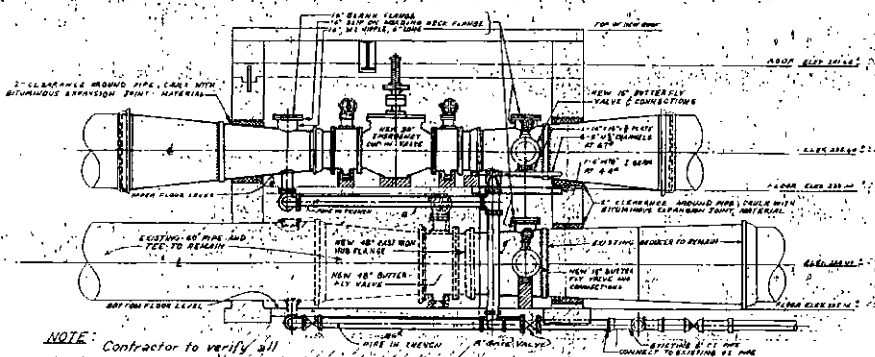
SCALE AS NOTED — APRIL 28, 1969

DR. BY J. J. MAJKOWSKI CK'D BY A.R.F.

W. B-1272-A



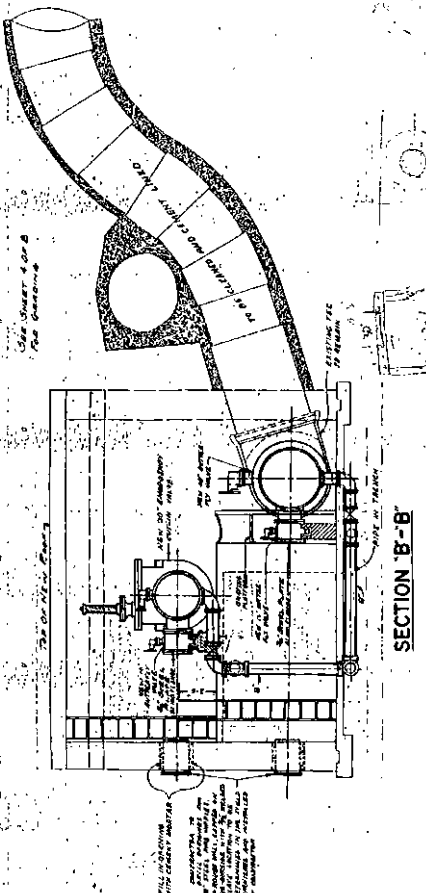
PLAN
VAULT "I"



SECTION "A-A"

NOTE: Contractor to verify all dimensions and elevations shown on this drawing in the field.

TYPICAL CONNECTION FOR REDUCERS
NO SCALE



SECTION "B-B"

NOTE: CITY TO FURNISH ALL VALVES AND HUB FLANGED FITTINGS. ANY MANHEADS REMOVED BECOME THE PROPERTY OF THE CITY. TRENCHES TO BE MADE FOR ALL PIPING WHICH EXTENDS BELOW FLOOR LEVEL; FOR DETAILS SEE DRAWING NO. B-1272. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS AND PIPE LOCATIONS IN THE FIELD.

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

Supt. Mechanical Division	11/20/68 Date
Supt. Div. Design & Construction	11/20/68 Date
Chief Engineer	11-21-68 Date
Director	11-21-68 Date

DEPARTMENT NO 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

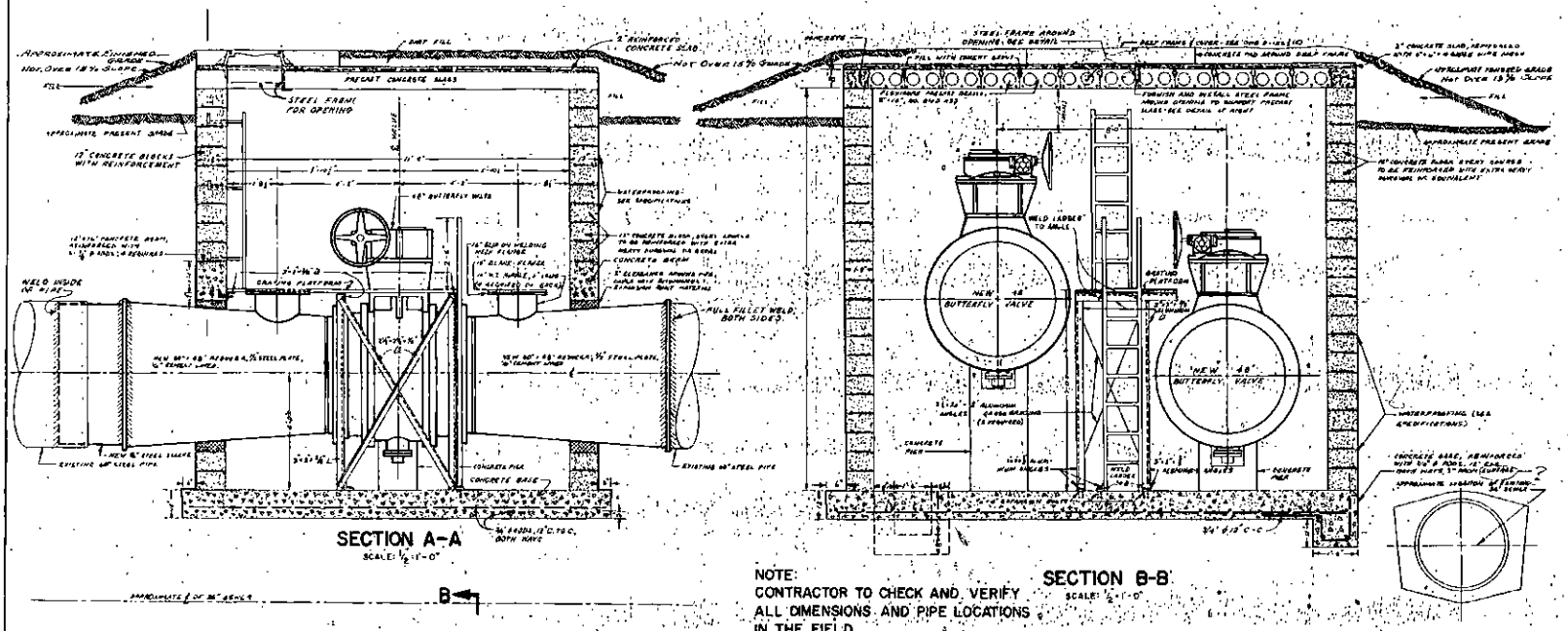
FROM PINE CREEK, ETNA BOROUGH, TO LANPHER RESERVOIR;
VALVES AND APPURTENANCES-VAULT NO. I
SHEET 5 OF 8 SHEETS

SCALE: ¼" = 1'-0" AUGUST 1968

DR. BY R.D. EICHELMAN TR. BY W.H.HENSTOCK CKD. BY A.R.F.

WB-1273

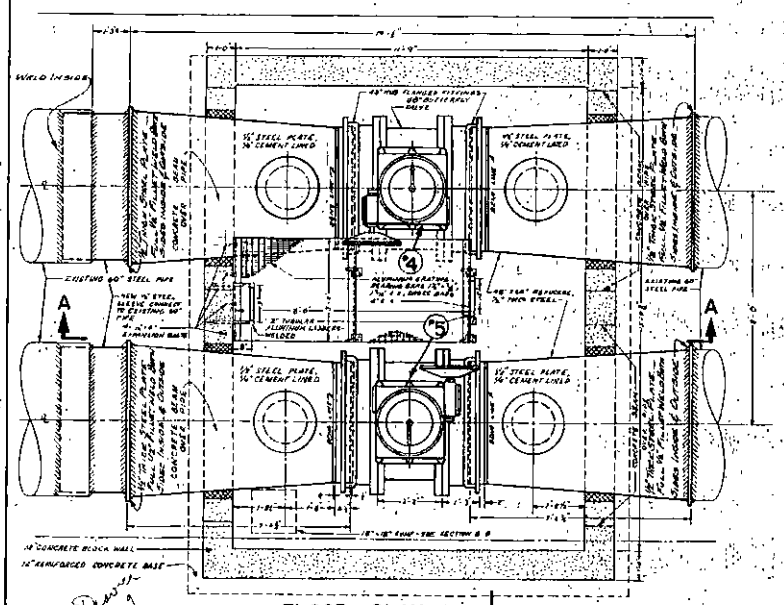
Exh RAWC-16



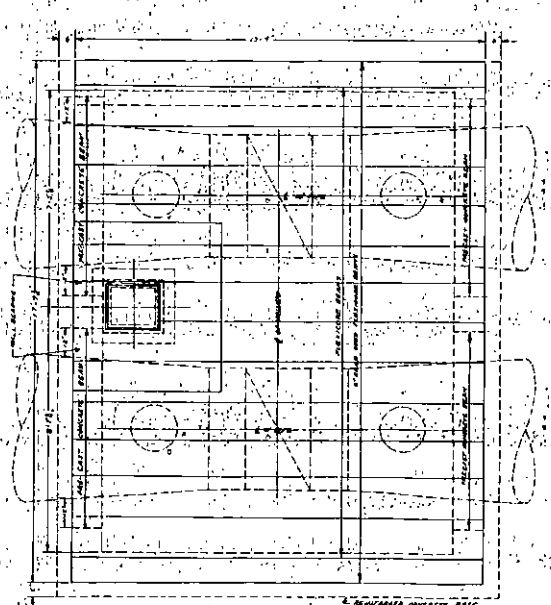
SECTION A-A
SCALE: 1/2"=1'-0"

SECTION B-B
SCALE: 1/2"=1'-0"

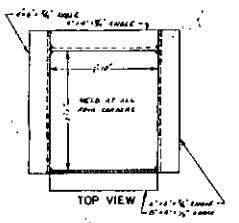
NOTE:
CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS AND PIPE LOCATIONS IN THE FIELD.



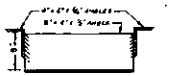
FLOOR PLAN B
SCALE 1/2"=1'-0"



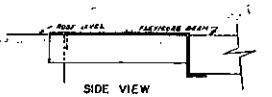
ROOF PLAN
SCALE 1/2"=1'-0"



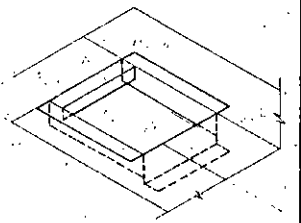
TOP VIEW



FRONT VIEW



SIDE VIEW
SCALE: 1"=1'-0"



DETAIL OF STEEL FRAME OPENING
SCALE: 3/4"=1'-0"

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

SUPT. MECHANICAL DIVISION	11/20/58 DATE
SUPT. DIV. DESIGN & CONSTRUCTION	11-21-58 DATE
CHIEF ENGINEER	11-21-58 DATE
DIRECTOR	11-21-58 DATE

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

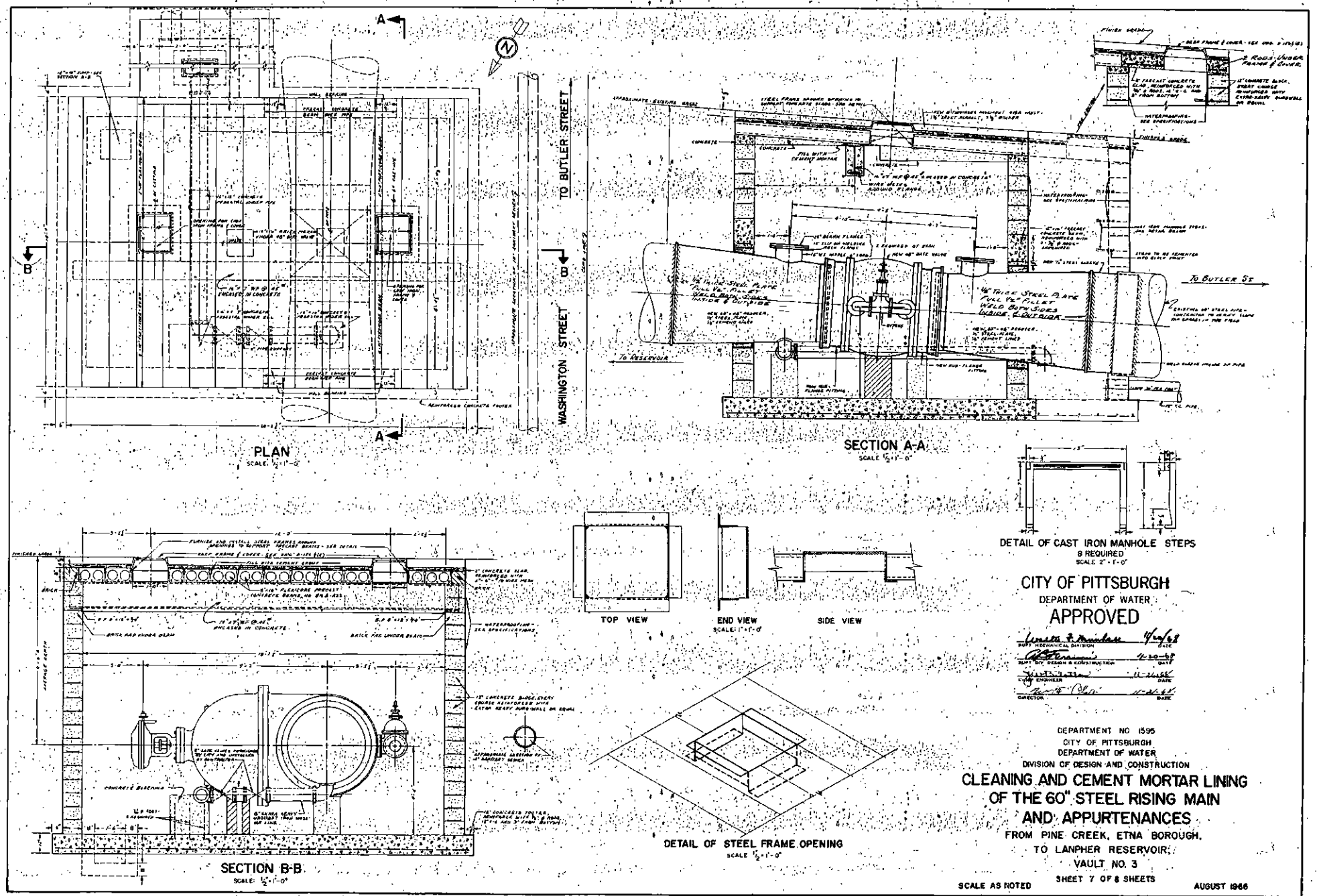
CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

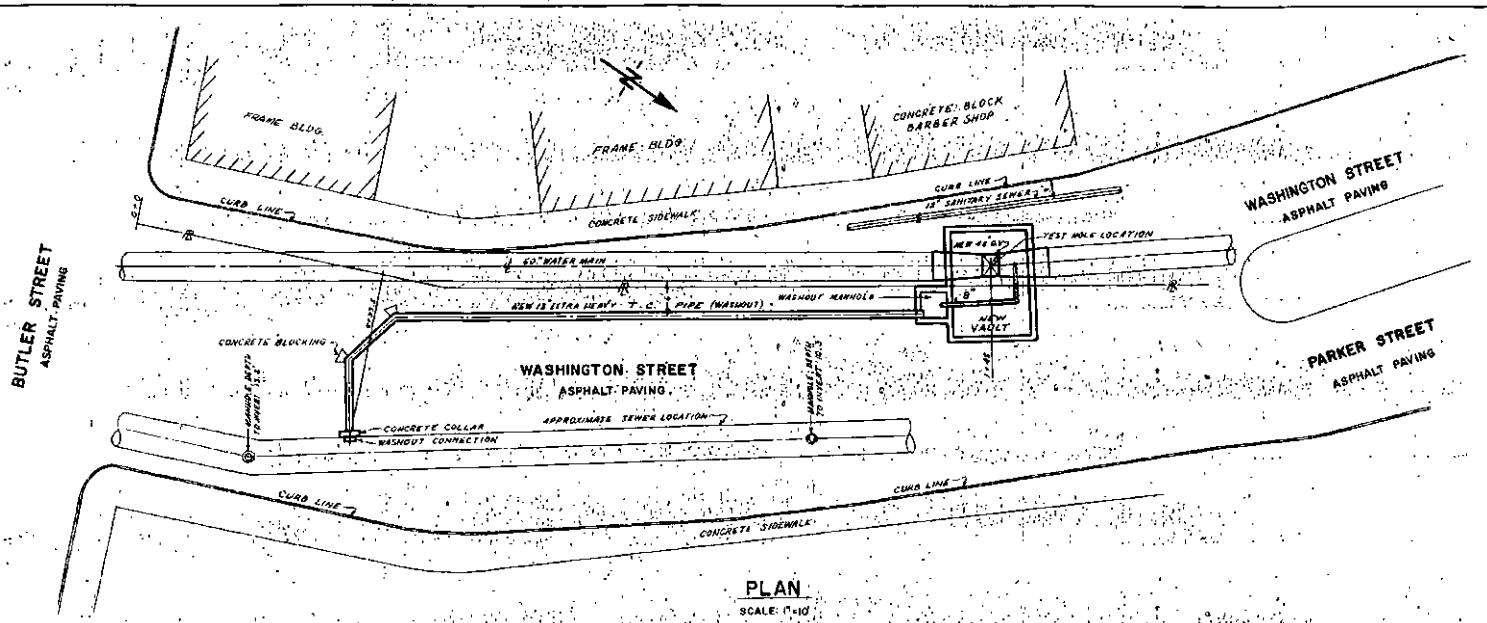
FROM PINE CREEK, ETNA BOROUGH, TO LANPHER RESERVOIR; VAULT NO. 2

SCALE AS NOTED — SHEET 6 OF 8 SHEETS — AUGUST 1958

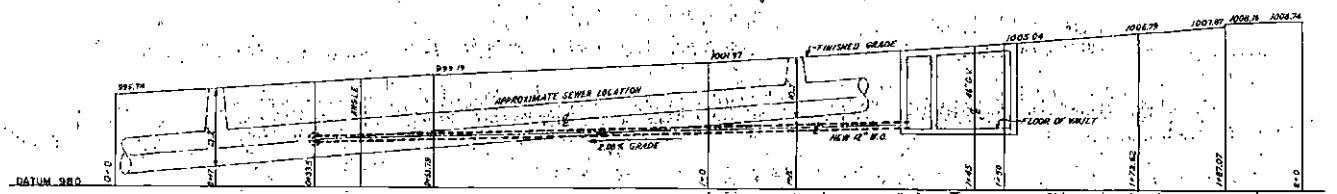
DR. BY R.D. EICHELMAN TR. BY W.H. HENSTOCK CKD. BY A.R.F.

WB-1274


PLAN
SCALE: 1/2"=1'-0"
TO BUTLER STREET
WASHINGTON STREET
SECTION A-A
SCALE 1/2"=1'-0"
TO BUTLER ST
TO RESERVOIR
DETAIL OF CAST IRON MANHOLE STEPS
8 REQUIRED
SCALE 2"=1'-0"
TOP VIEW
END VIEW
SCALE: 1"=1'-0"
SIDE VIEW
SECTION B-B
SCALE: 1/2"=1'-0"
DETAIL OF STEEL FRAME OPENING
SCALE 1/2"=1'-0"
CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED
SUPT. MECHANICAL DIVISION
DATE
SUPT. DIV. DESIGN & CONSTRUCTION
DATE
CHIEF ENGINEER
DATE
DIRECTOR
DATE
DEPARTMENT NO 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION
CLEANING AND CEMENT MORTAR LINING
OF THE 60" STEEL RISING MAIN
AND APPURTENANCES
FROM PINE CREEK, ETNA BOROUGH,
TO LANPHER RESERVOIR;
VAULT NO. 3
SHEET 7 OF 8 SHEETS
SCALE AS NOTED
AUGUST 1966
DR. BY W.H. HENSTOCK TR BY W.H. HENSTOCK CKD. BY A.R.F.
WB-1275



PLAN
SCALE: 1"=10'



PROFILE
SCALE 1"=10'
(HORIZ. & VERT.)

CITY OF PITTSBURGH
DEPARTMENT OF WATER
APPROVED

SUPT. MECHANICAL DIVISION	DATE 11/20/68
SUPT. DIV. DESIGN & CONSTRUCTION	DATE 11/20/68
	DATE 11-21-68
DIRECTOR	DATE 11-21-68

DEPARTMENT NO. 1595
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN AND CONSTRUCTION

CLEANING AND CEMENT MORTAR LINING OF THE 60" STEEL RISING MAIN AND APPURTENANCES

FROM PINE CREEK, ETNA BOROUGH,
TO LANPHER RESERVOIR
LOCATION OF 12" T.C. SEWER AND PROFILE

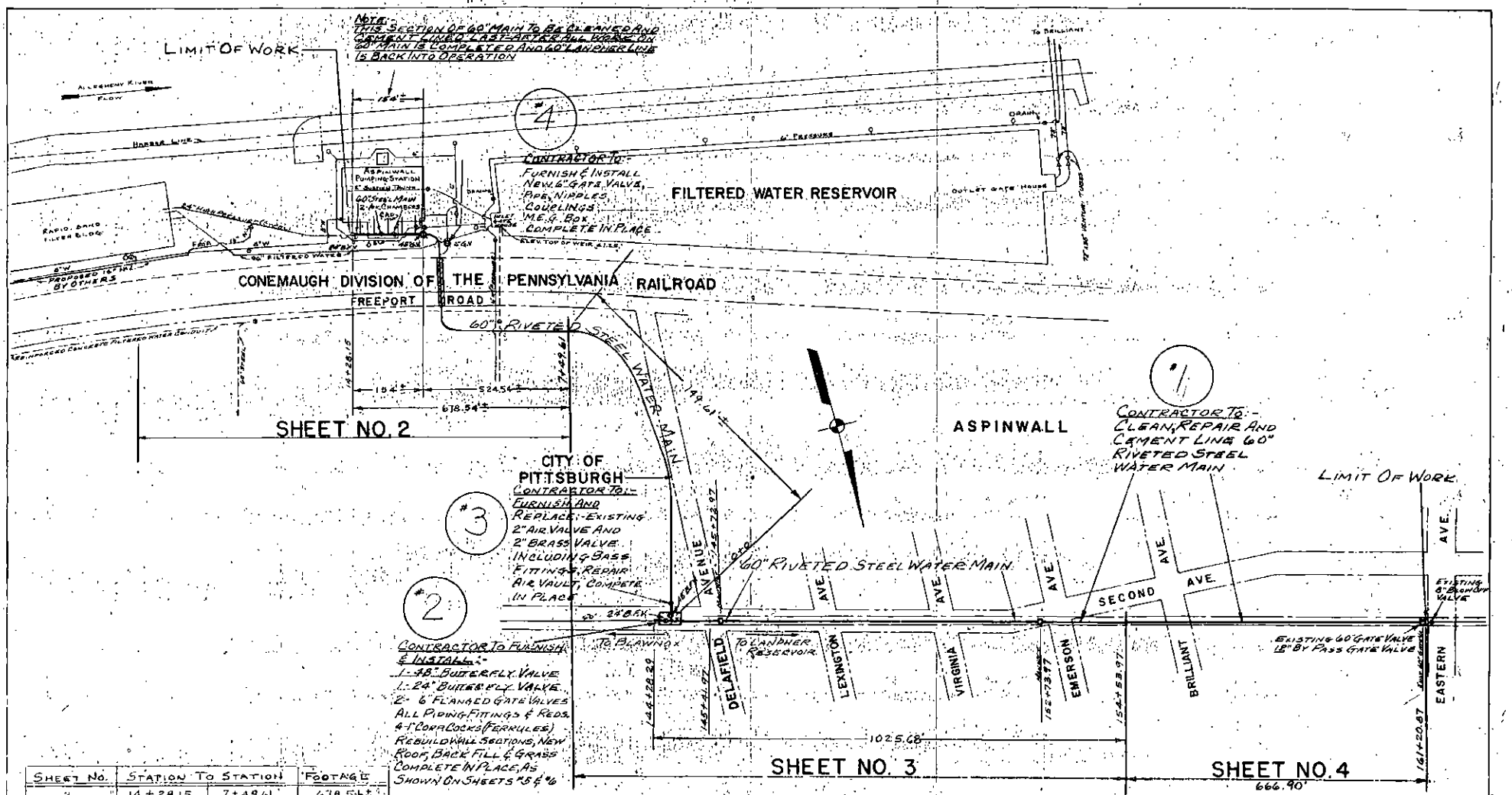
SHEET 8 OF 8 SHEETS

SCALE AS NOTED

AUGUST, 1968

DR. BY W.H. HENSTOCK TR. BY J.J. DEMPSEY CK'D. BY A.R.F.

WB-1276



LOCATION PLAN
SCALE: 1" = 100'

SHEET NO.	STATION	TO STATION	FOOTAGE
2	14+28.15	7+49.61	678.54±
3	7+49.61	0+00.00	749.61±
3	144+28.29	145+41.97	113.68±
3	145+41.97	154+53.97	912.00±
4	154+53.97	161+20.87	666.90±

TOTAL = 3,120.73± 60" RIVETED STEEL PIPE TO BE CLEANED & CEMENT LINING

DEPT. OF WATER NO. 1672
CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN

EASTERN AVENUE TO ASPINWALL PUMPING STATION

WATER DEPARTMENT

APPROVED	DATE	APPROVED	DATE
J. W. Beck, Supt. Supply Div.	3-4-75	[signature], Design Division Engr.	2/28/75
John [signature], Director	3-5-75	Anthony Mischmeyer, Div. Engr. Water	2/28/75
		[signature], Director	

SCALE AS SHOWN

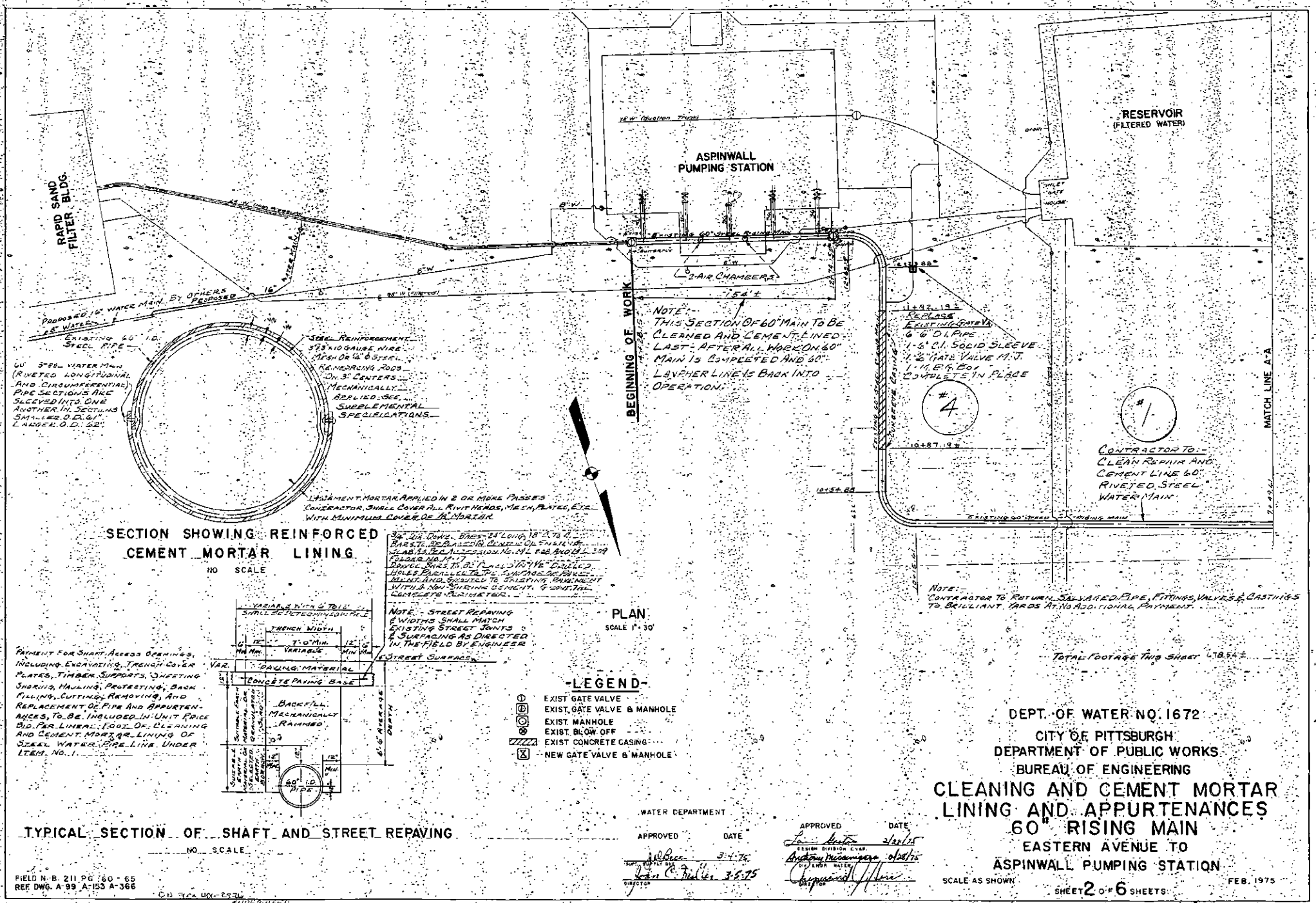
SHEET 1 OF 6 SHEETS

FEB. 1975

REF DWG. A-99, A-247, A-385, A-384, A-314

DRAWN & TRACED BY R.D. EICHELMAN SUPERVISED CHKD BY A.R.F.

W B-1540



SECTION SHOWING REINFORCED CEMENT MORTAR LINING

NO SCALE

¾" DIA. DOWEL BARS 24" LONG, 18" O. TO O. BARS TO BE PLACED IN CENTER OF EXISTING SLAB AS PER AGREEMENT NO. 1491 DAB AND DAB 209 FILED IN M.O.T. DOWEL BARS TO BE DRILLED IN ½" DRILLED HOLES PARALLEL TO THE SURFACE OF PAVEMENT AND GROUTED TO EXISTING PAVEMENT WITH A NON SHRINK CEMENT & GROUT MIX CONCRETE REINFORCED

NOTE - STREET REPAVING & WIDTHS SHALL MATCH EXISTING STREET JOINTS & SURFACING AS DIRECTED IN THE FIELD BY ENGINEER

PLAN

SCALE 1" = 30'

Payment for Shaft Access Openings, Including Excavating, Trench Cover Plates, Timber Supports, Sheeting Shoring, Hauling, Protecting, Back Filling, Cutting, Removing, and Replacement of Pipe and Appurtenances, To Be Included In Unit Price Bid Per Lineal Foot Of Cleaning and Cement Mortar Lining of Steel Water Pipe Line Under Item No. 1

TYPICAL SECTION OF SHAFT AND STREET REPAVING

NO SCALE

-LEGEND-

- EXIST GATE VALVE
- EXIST GATE VALVE & MANHOLE
- EXIST MANHOLE
- EXIST BLOW OFF
- EXIST CONCRETE CASING
- NEW GATE VALVE & MANHOLE

WATER DEPARTMENT

	APPROVED	DATE
SUP. SUPPLY DIV.	J.W. Beer	3-4-75
DIRECTOR	Wm. E. Miller	3-5-75

	APPROVED	DATE
DESIGN DIVISION CHIEF	Lo Hunter	3/28/75
DIVISION WATER	Anthony Mascaro	04/28/75
DIRECTOR	Raymond J. Shea	

DEPT. OF WATER NO. 1672

CITY OF PITTSBURGH

DEPARTMENT OF PUBLIC WORKS

BUREAU OF ENGINEERING

CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN EASTERN AVENUE TO ASPINWALL PUMPING STATION

SCALE AS SHOWN FEB. 1975

SHEET 2 OF 6 SHEETS

FIELD N. B. 211 PG 80 - 85

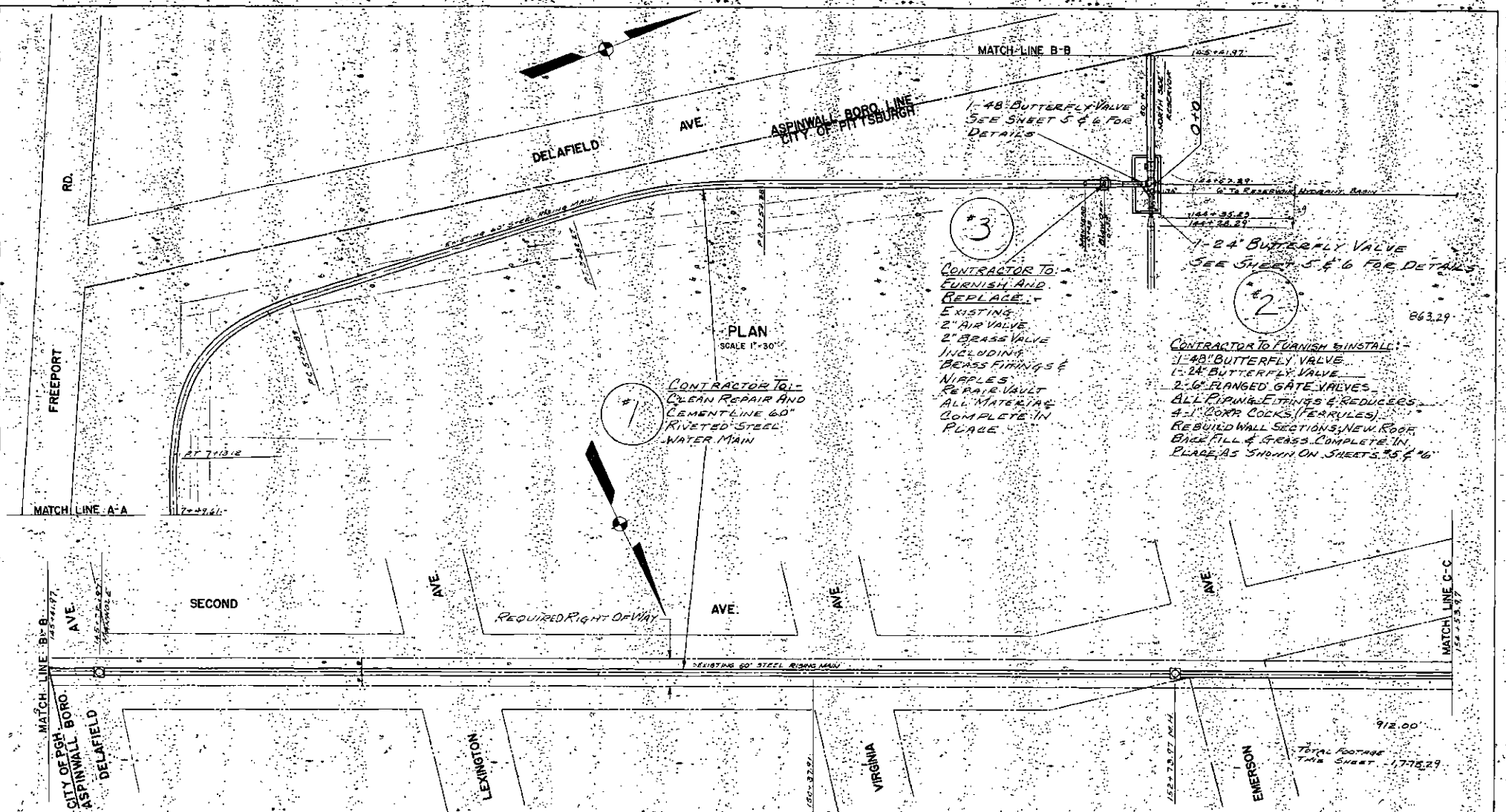
REF. DWG. A-99 A-153 A-366

CN 304 UG-2576

SUPERVISED

DRAWN BY R. D. EICHELMAN TRACED BY L. STEIGER CHKD. BY A.R.F.

WB-1541



DEPT. OF WATER NO. 1672

CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN

EASTERN AVENUE TO ASPINWALL PUMPING STATION

SCALE AS SHOWN

SHEET 3 OF 6 SHEETS

FEB. 1975

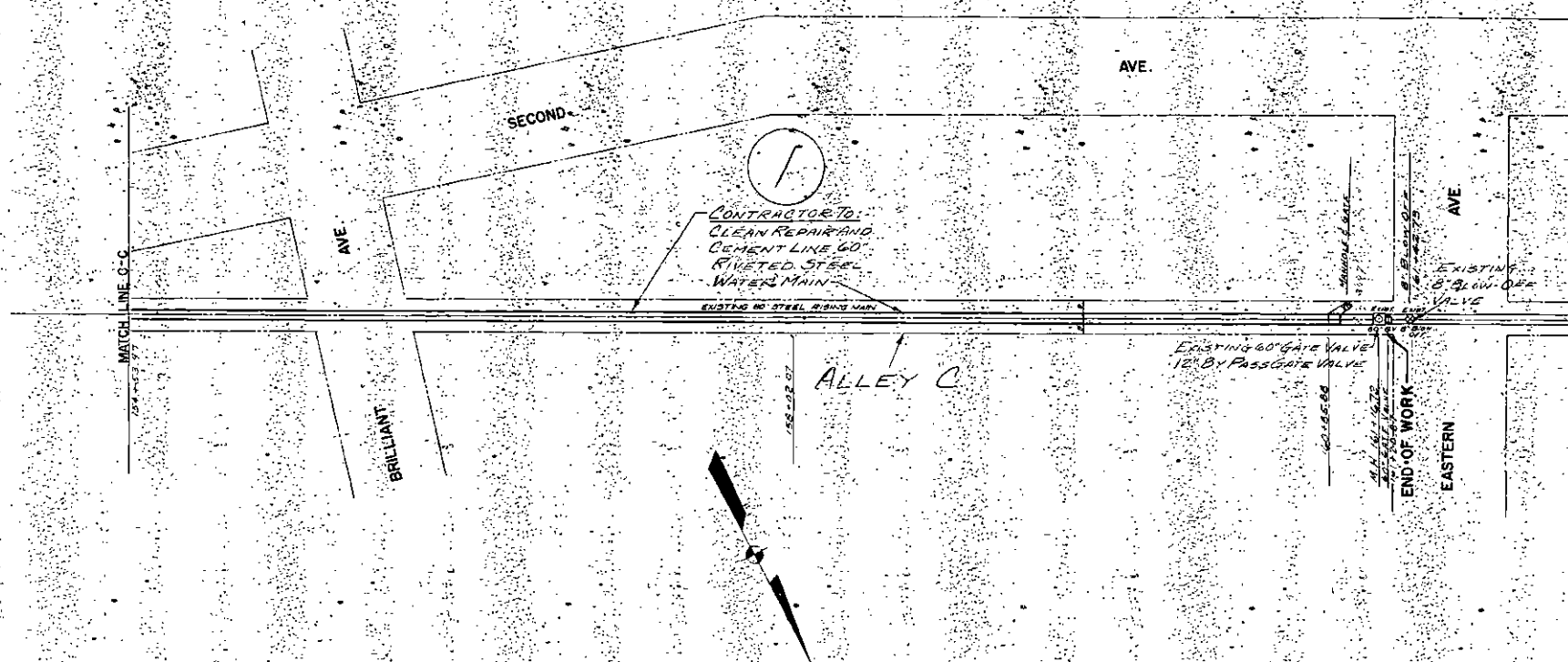
WATER DEPARTMENT

APPROVED	DATE	APPROVED	DATE
J. O. Pace, SUPT. DIV. ENG.	3-4-75	Louis Dantoni, DESIGN DIVISION ENGR.	2/20/75
John C. Miller, DIRECTOR	3-5-76	Anthony Mecenzano, DIV. ENGR. WATER	2/28/75
		Raymond Jones, DIRECTOR	

REF. DWG. A-366 A-246 A-247 B-383 B-315 D.N. BOOK 456-27-29

DRAWN BY R. D. EICHELMAN TRACED BY L. STEIGER CHKD. BY A.R.F. SUPERVISED

WB-1542



PLAN
SCALE 1" = 30'

TOTAL FOOTAGE: 666.90

TOTAL FOOTAGE: WHOLE JOB: 31+20.73±

DEPT. OF WATER NO. 1672

CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN

EASTERN AVENUE TO
ASPINWALL PUMPING STATION

SCALE AS SHOWN

FEB. 1975

SHEET 4 OF 6 SHEETS

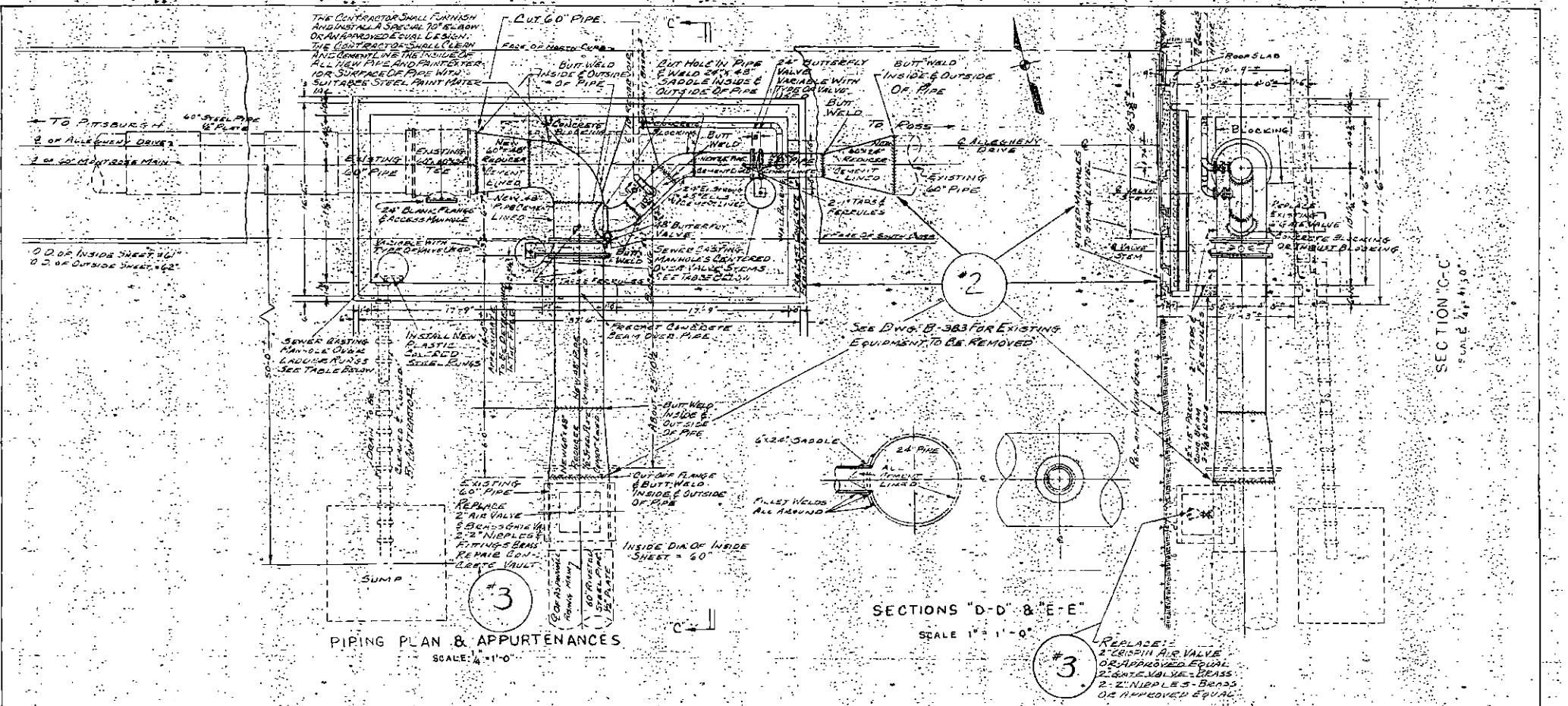
WATER DEPARTMENT

APPROVED	DATE	APPROVED	DATE
[signature]	3-4-75	[signature]	3/4/75
[signature]	3-5-75	[signature]	3/5/75

REF DWG B-1233 ON BOOK 406-30

DRAWN BY R. D. EICHELMAN TRACED BY L. STEIGER SUPERVISED CHKD. BY A.R.F.

W B-1543



PIPING PLAN & APPURTENANCES
SCALE: ¼" = 1'-0"

SECTIONS "D-D" & "E-E"
SCALE 1" = 1'-0"

THE CONTRACTOR SHALL FURNISH-INSTALL ALL MATERIALS AND COMPLETE ALL ITEMS OF WORK AS SHOWN ON SHEETS #5 & #6 COMPLETE IN PLACE

MANHOLE	CAST NO	NO. REQ'D.
FRAME	26	3
LID	25	3

WATER DEPARTMENT

APPROVED	DATE	APPROVED	DATE
J. O. Bach, SUPT. SUPPL. DIV.	3-4-75	[signature], DESIGN DIVISION ENGR.	2/27/75
[signature], DIRECTOR	3-5-75	Anthony Mascomarro, ENGR. WATER	2/28/75
		[signature], DIRECTOR	

DEPT. OF WATER NO. 1672
CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

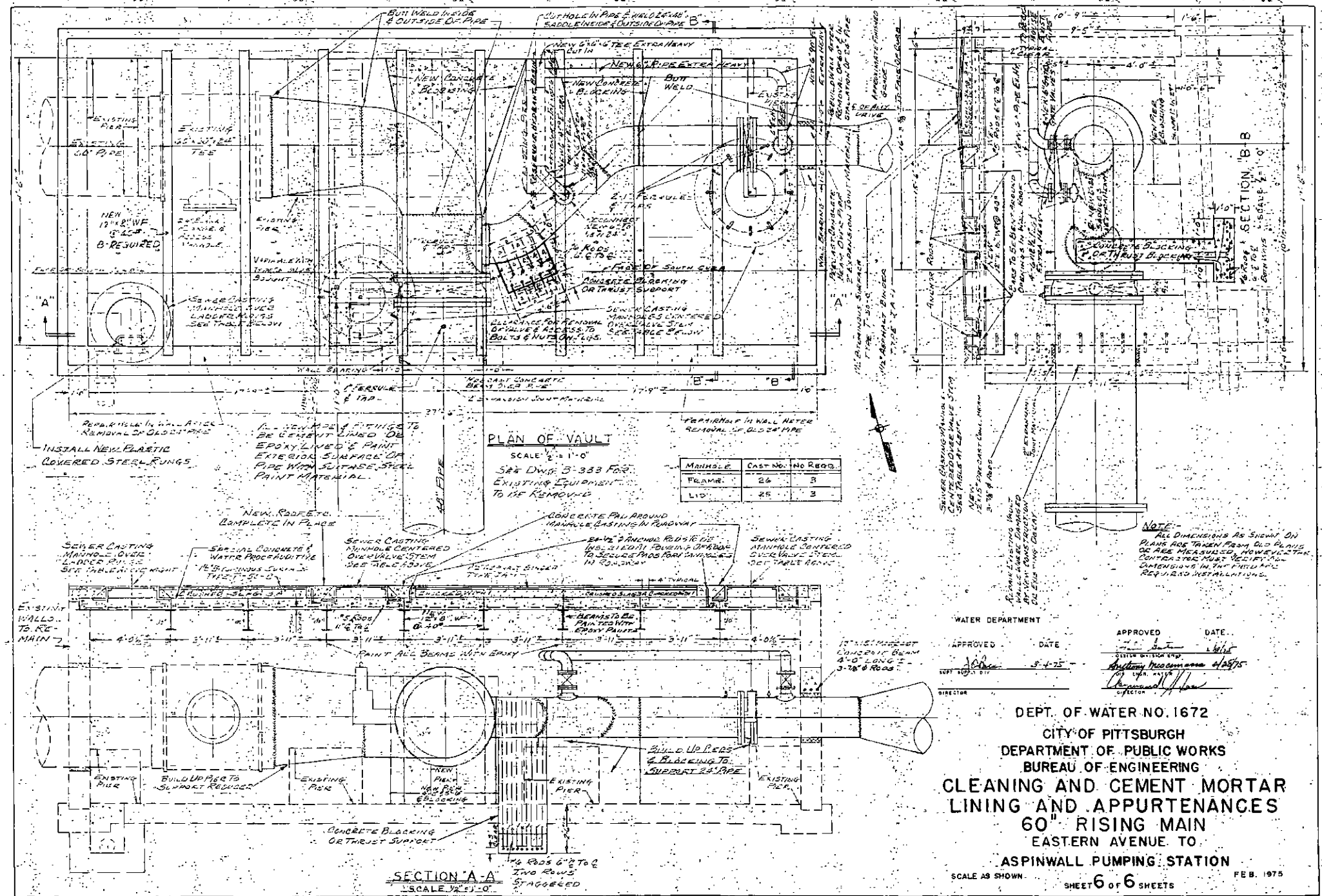
CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN

EASTERN AVENUE TO ASPINWALL PUMPING STATION

SCALE AS SHOWN — SHEET 5 OF 6 SHEETS — FEB. 1975 25/50

DRAWN BY R.D. EICHELMAN TRACED BY R.D. EICHELMAN SUPERVISED CHKD. BY A.R.F.

W B-1544



MANHOLE	CAST NO.	NO REQD.
FRAME	26	3
LID	25	3

WATER DEPARTMENT

APPROVED	DATE
SUPT. SUPPLY DIV.	3-4-75
DIRECTOR	

APPROVED	DATE
DESIGN DIVISION ENGR.	4/28/75
DIV. ENGR. WATER	4/28/75
DIRECTOR	

DEPT. OF WATER NO. 1672

CITY OF PITTSBURGH
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING

CLEANING AND CEMENT MORTAR LINING AND APPURTENANCES 60" RISING MAIN

EASTERN AVENUE TO
ASPINWALL PUMPING STATION

SCALE AS SHOWN — SHEET 6 OF 6 SHEETS — FEB. 1975

DRAWN BY R.D. EICHELMAN TRACED BY R.D. EICHELMAN SUPERVISED CHKD. BY A.R.F.

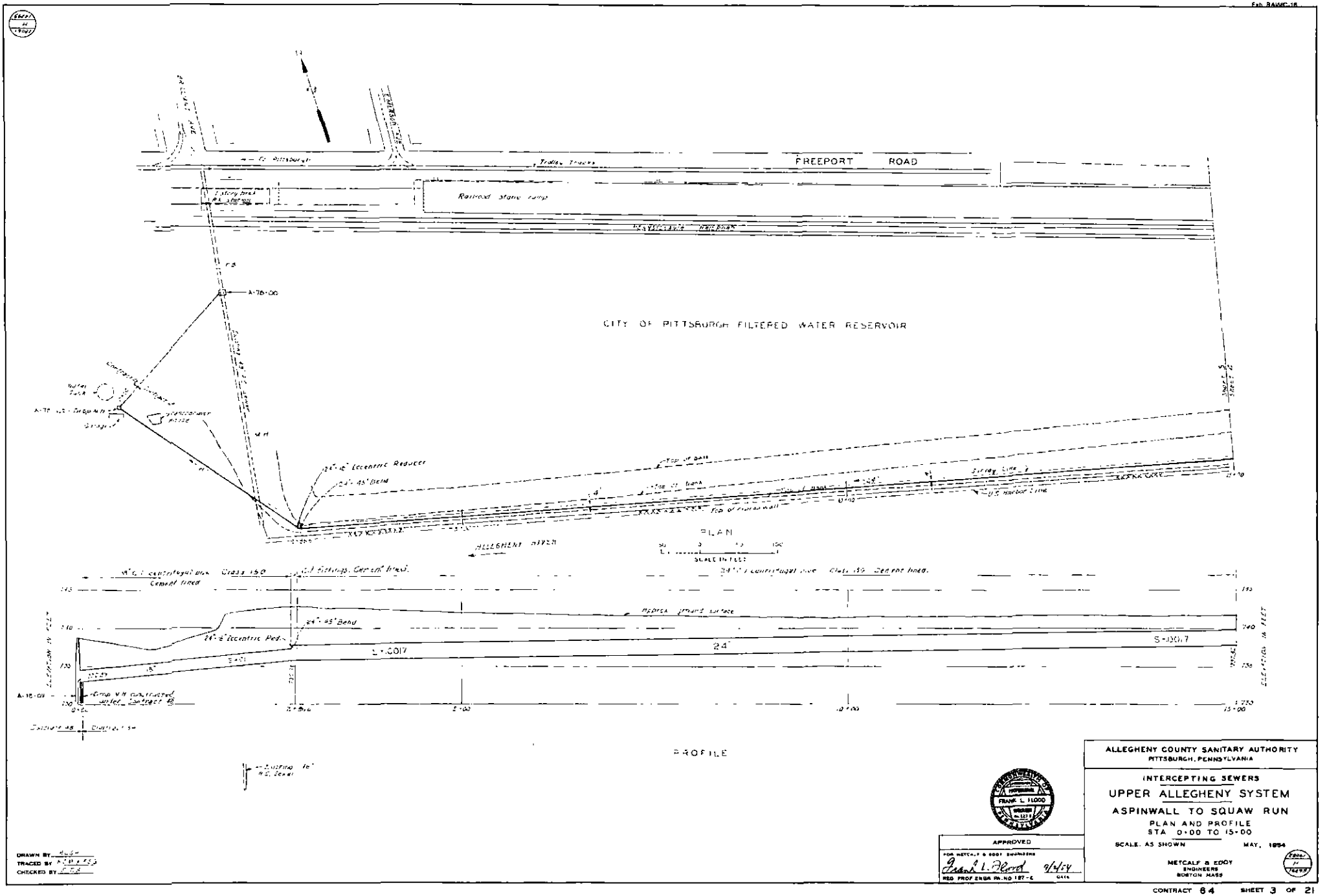
WB-1545

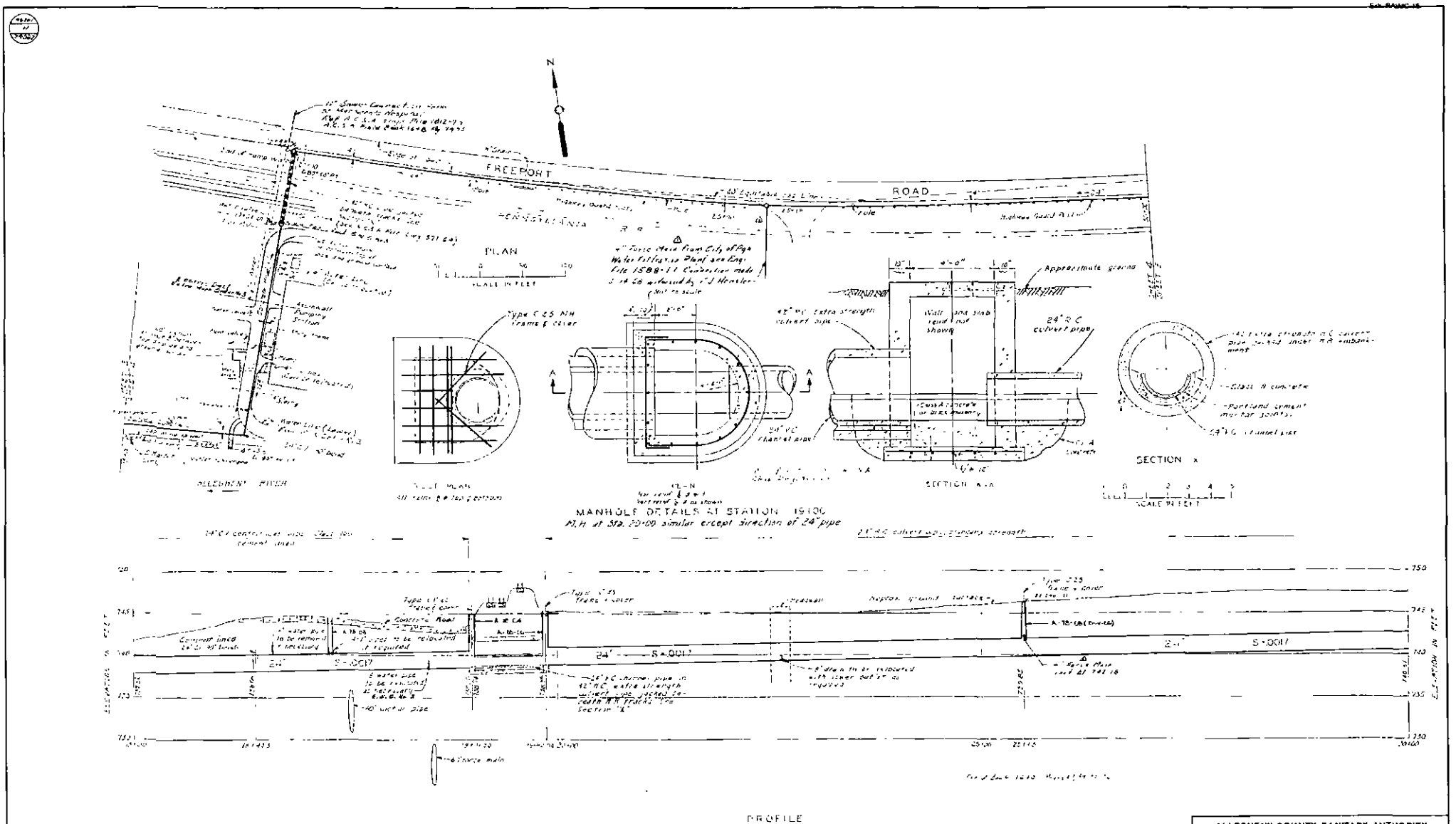
Exh. RAW/C-16

Etna Street 60 Inch Transmission Main - Location Map






FREEPORT ROAD
Trolley Tracks
Railroad stone ramp
CITY OF PITTSBURGH FILTERED WATER RESERVOIR
24"-16" Eccentric Reducer
24"-45° Bend
Top of Bank
Top of Riprap wall
U.S. Harbor Line
ALLEGHENY RIVER
PLAN
SCALE IN FEET
24"-6" Eccentric Red.
24"-45° Bend
S-.0017
24"
PROFILE
ELEVATION IN FEET
DRAWN BY
TRACED BY
CHECKED BY
APPROVED
FOR METCALF & EDDY ENGINEERS
REG. PROF. ENGR. PA. NO. 187-E
DATE
ALLEGHENY COUNTY SANITARY AUTHORITY
PITTSBURGH, PENNSYLVANIA
INTERCEPTING SEWERS
UPPER ALLEGHENY SYSTEM
ASPINWALL TO SQUAW RUN
PLAN AND PROFILE
STA 0+00 TO 15+00
SCALE: AS SHOWN
MAY, 1954
METCALF & EDDY
ENGINEERS
BOSTON MASS
CONTRACT 64
SHEET 3 OF 21



ALLEGHENY COUNTY SANITARY AUTHORITY
PITTSBURGH, PENNSYLVANIA

INTERCEPTING SEWERS

UPPER ALLEGHENY SYSTEM

ASPINWALL TO SQUAW RUN

PLAN AND PROFILE

STA 15+00 TO 30+00

SCALE, AS SHOWN MAY, 1954

METCALF & EDDY
ENGINEERS
BOSTON MASS

APPROVED

FOR METCALF & EDDY ENGINEERS

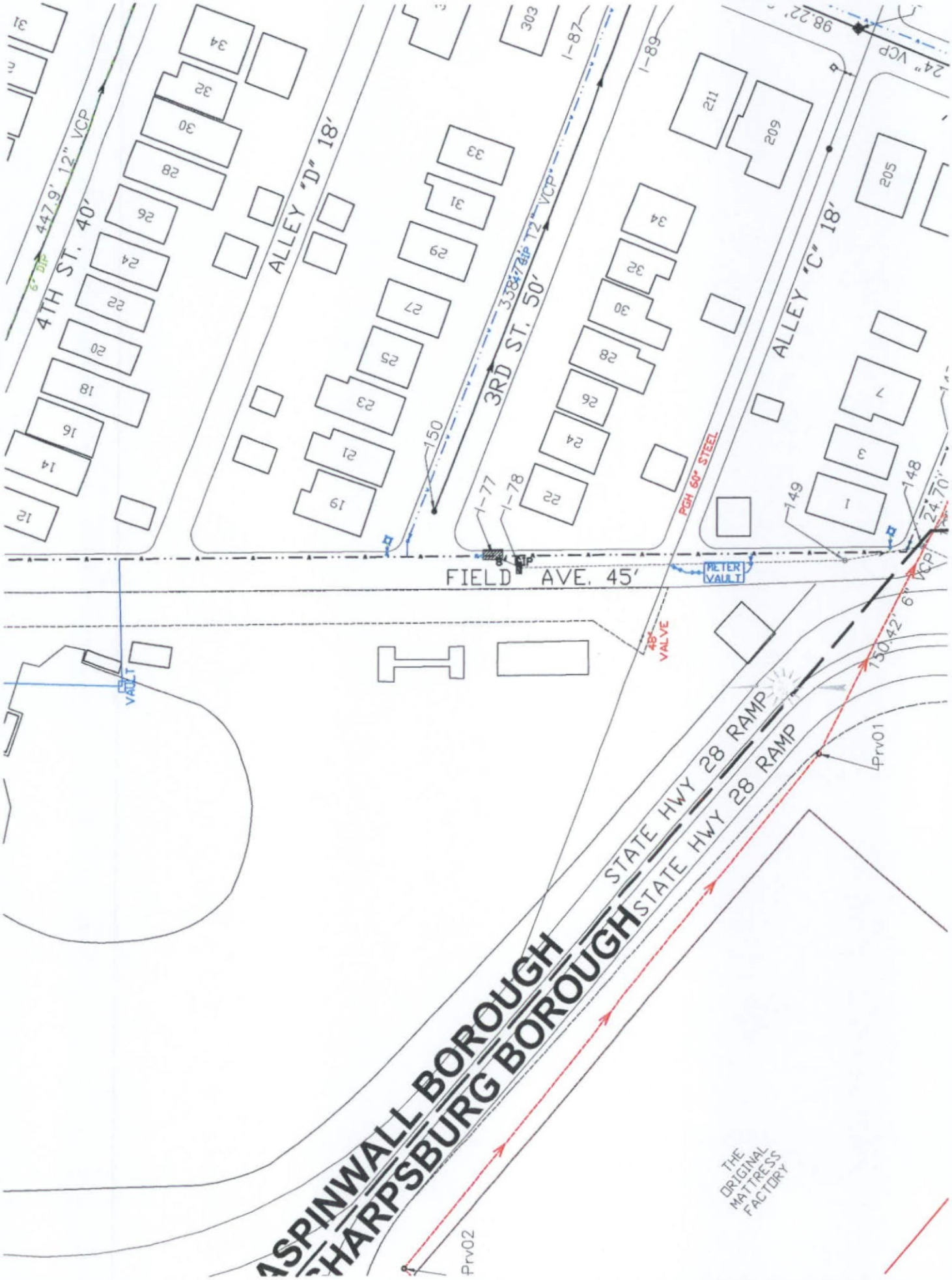
Frank L. Flood 9/2/54

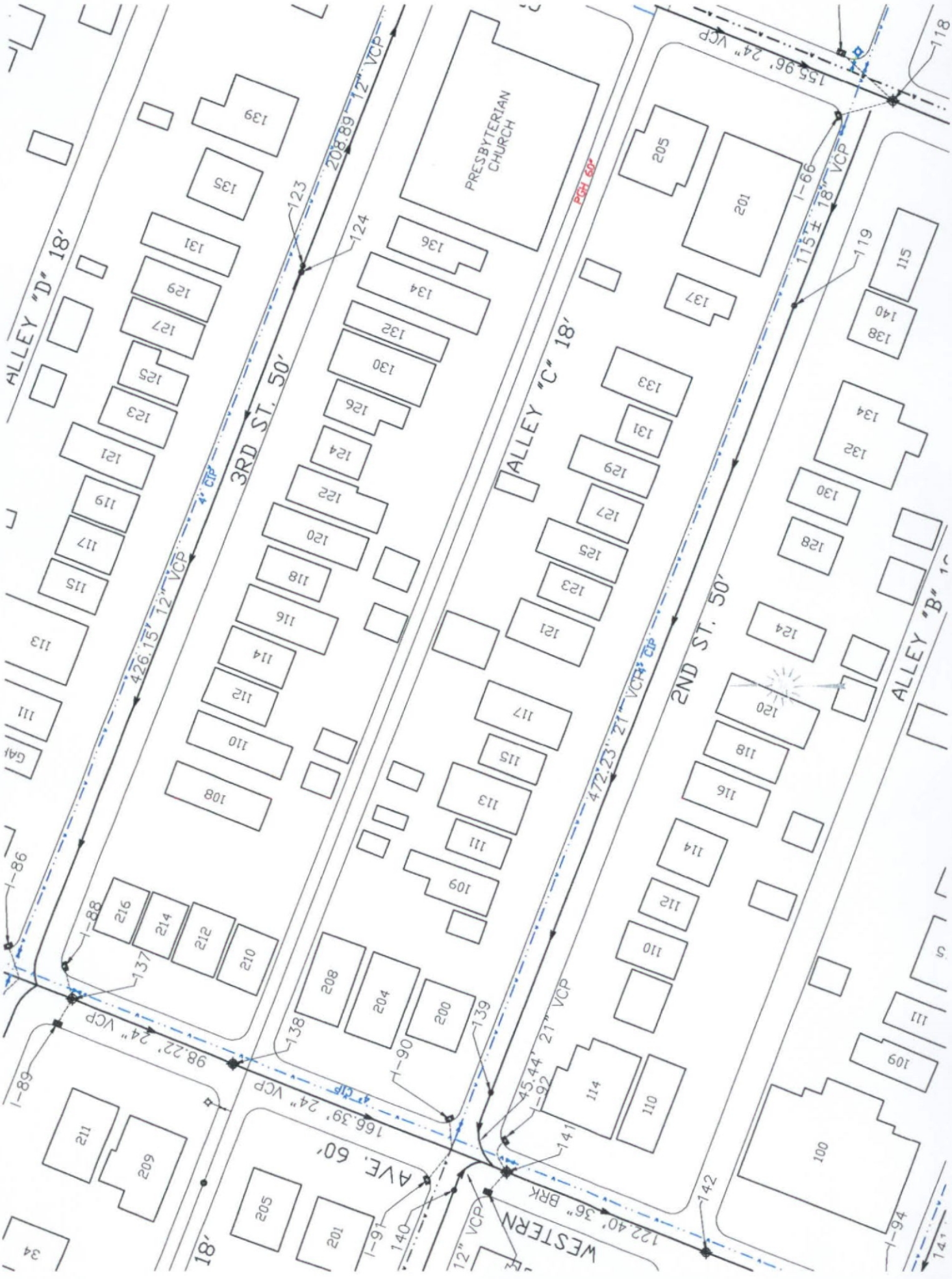
REG. PROF. ENGR. PA. NO. 137-E DATE

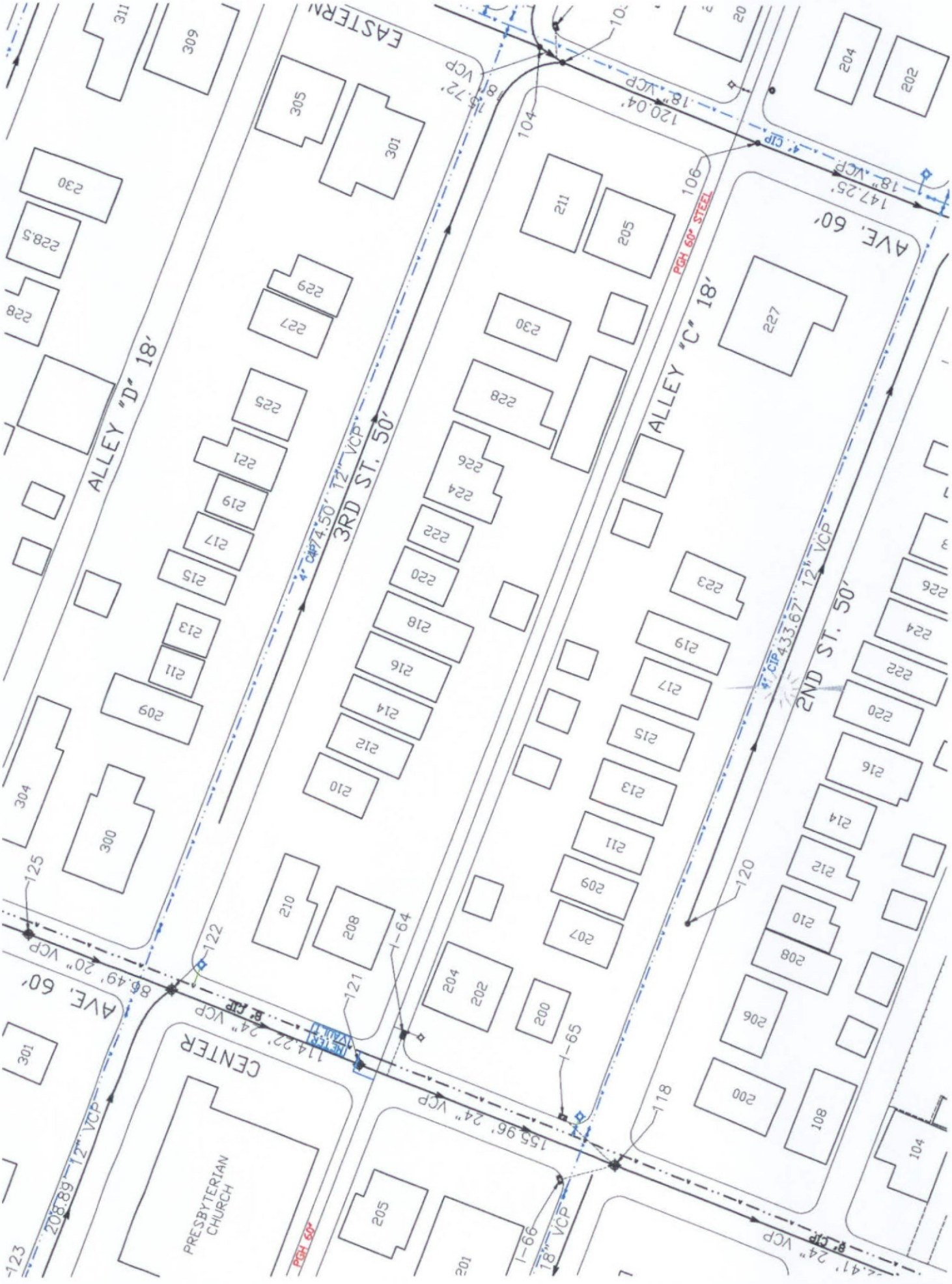
DRAWN BY
TRACED BY
CHECKED BY

CONTRACT 64 SHEET 4 OF 21

Exh. RAW/C-16


4TH ST. 40'
447.9' 12" VCP
ALLEY "D" 18'
3RD ST. 50'
ALLEY "C" 18'
I-87
I-89
I-77
I-78
150
PGH 60" STEEL
FIELD AVE. 45'
METER VAULT
48" VALVE
VAULT
STATE HWY 28 RAMP
STATE HWY 28 RAMP
ASPINWALL BOROUGH
HARPSBURG BOROUGH
Prv01
Prv02
THE ORIGINAL MATTRESS FACTORY


PRESBYTERIAN CHURCH
ALLEY "D" 18'
3RD ST. 50'
ALLEY "C" 18'
2ND ST. 50'
ALLEY "B"
AVE. 60'
WESTERN
208.89' 12" VCP
426.15' 12" VCP
472.23' 21" VCP
155.96' 24" VCP
115' ± 18" VCP
98.22' 24" VCP
166.39' 24" VCP
45.44' 21" VCP
122.40' 36" BRK
4' CIP
PGH 60'
I-66
I-86
I-88
I-89
I-90
I-91
I-92
I-94
118
119
123
124
137
138
139
140
141
142


EASTERN
ALLEY "D" 18'
3RD ST. 50'
ALLEY "C" 18'
2ND ST. 50'
AVE. 60'
AVE. 60'
CENTER
PRESBYTERIAN CHURCH
PGH 60' STEEL
PGH 60'
4" CIP 74.50' 12" VCP
4" CIP 433.67' 12" VCP
4" CIP
8" CIP
8" CIP
86.49' 20" VCP
114.22' 24" VCP
155.96' 24" VCP
208.89' 12" VCP
120.04' 18" VCP
147.25' 18" VCP
I-64
I-65
I-66
104
106
118
120
121
122
123
125

VIRGINIA AV
LEXINGTON AVE. 50'
DELAFIELD AVE
2ND ST. 50'
253.55' 10" VCP
287.64' 10" VCP
301.30' 10" VCP
302.20' 10" VCP
299.07' 10" VCP
284.44'
274.0
4" CIP
59.82' 15" VCP
104.63' 15" VCP
49.82' 15" VCP
206.17' 15" VCP
51.06' 15" VCP
184.62' 15" CIPP
12.26' 10" PVC
10" VCP
I-150
I-149
I-156
I-157
I-169
PGH 60'
043
044
025
026
041
059
059.1
040
042
028
027
039
029
030
007
008
009

Exh. RAWC-16



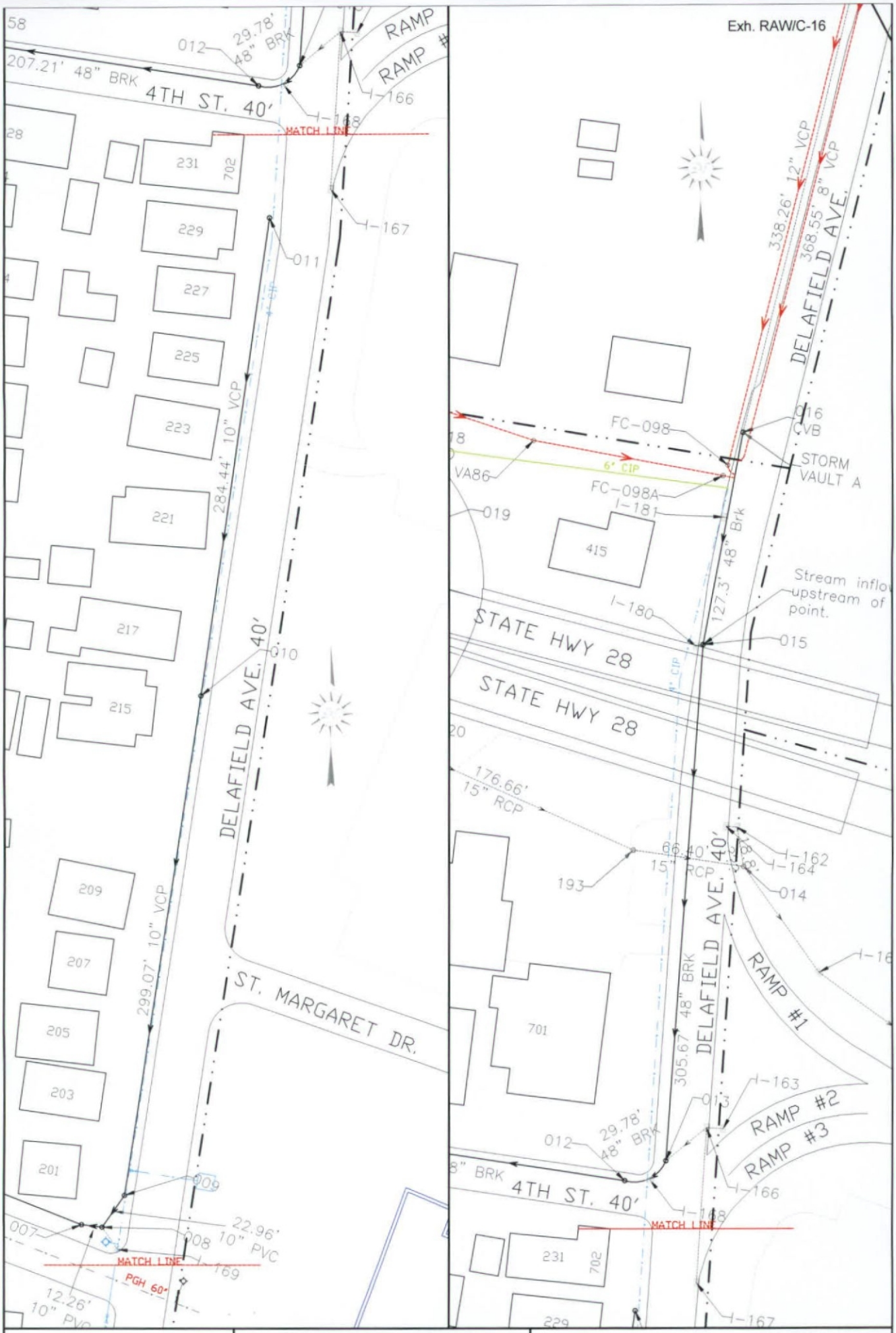
ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: As Shown 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS



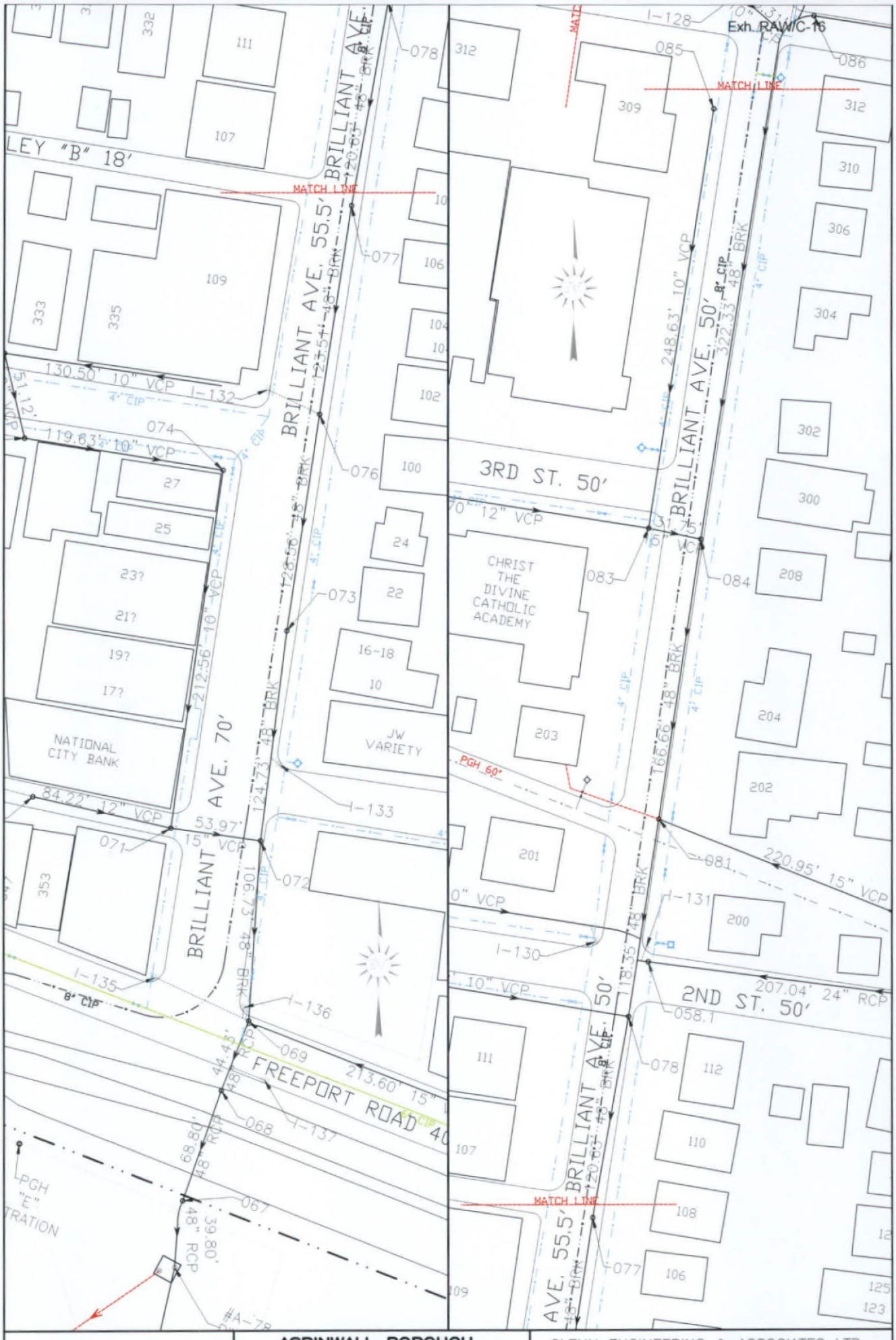
ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: As Shown 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: As Shown 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

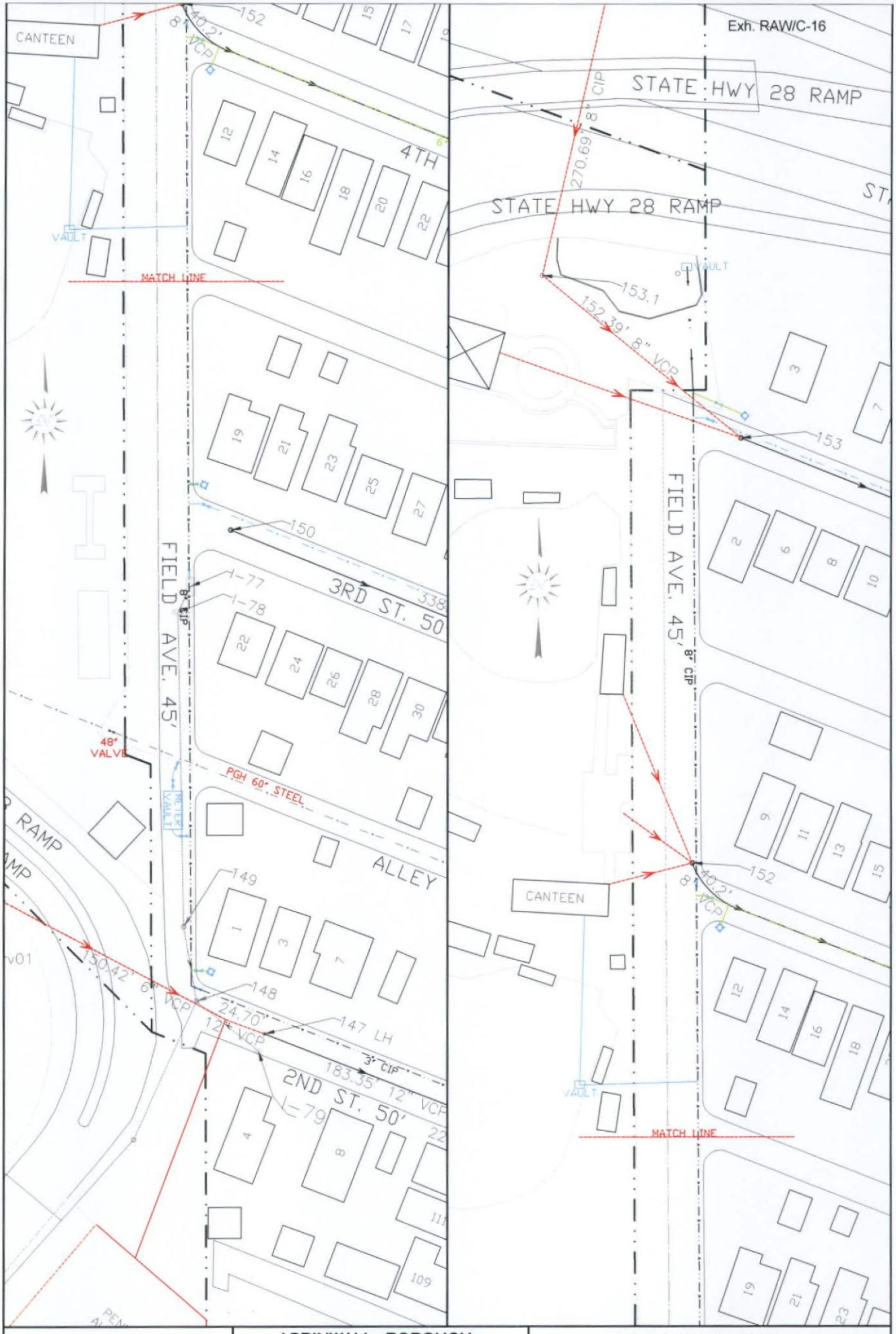
GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: As Shown 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: As Shown 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: Not to Scale 12/18/15

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: Not to Scale 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers — North Huntingdon, PA

Scale: Not to Scale 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH G.I.S. MAPPING *for the* **BOROUGH OF ASPINWALL ALLEGHENY COUNTY, PA**	GLENN ENGINEERING & ASSOCIATES LTD. *Registered Engineers – North Huntingdon, PA*	BOROUGH UTILITY LOCATIONS
	Scale: Not to Scale 12/18/15 0' 50'	

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

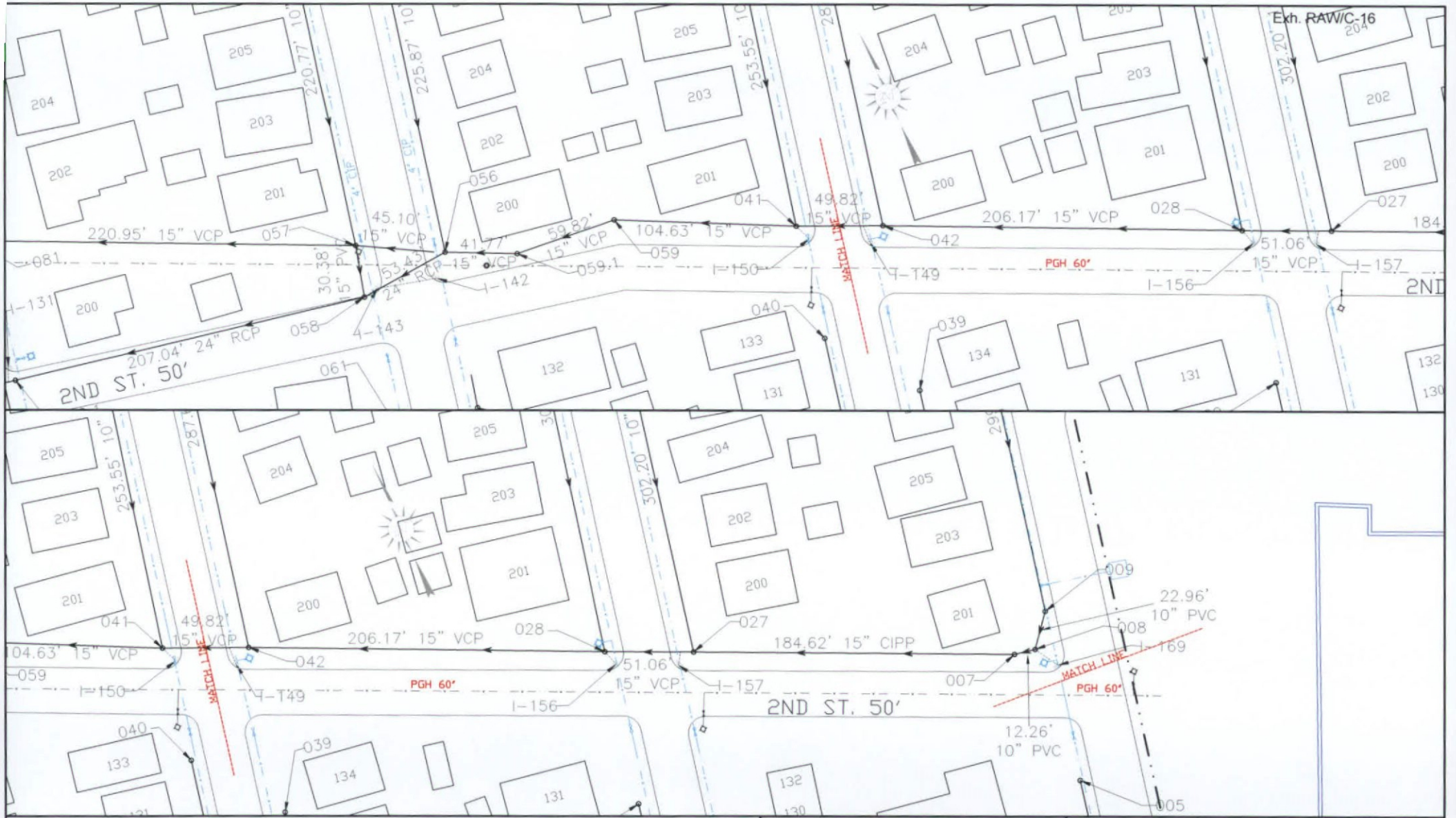
GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: Not to Scale 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS

Exh. RAW/C-16



ASPINWALL BOROUGH
G.I.S. MAPPING
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers – North Huntingdon, PA

Scale: Not to Scale 12/18/15

0' 50'

BOROUGH UTILITY LOCATIONS



G.I.S. MAPPING
COMBINED SEWER SYSTEM
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers — North Huntingdon, PA

Scale: Not to Scale

0'

Date: 1/18/2016

MISC. SEWER LOCATIONS

Exh. RAW/C-16



G.I.S. MAPPING
COMBINED SEWER SYSTEM
for the
BOROUGH OF ASPINWALL
ALLEGHENY COUNTY, PA

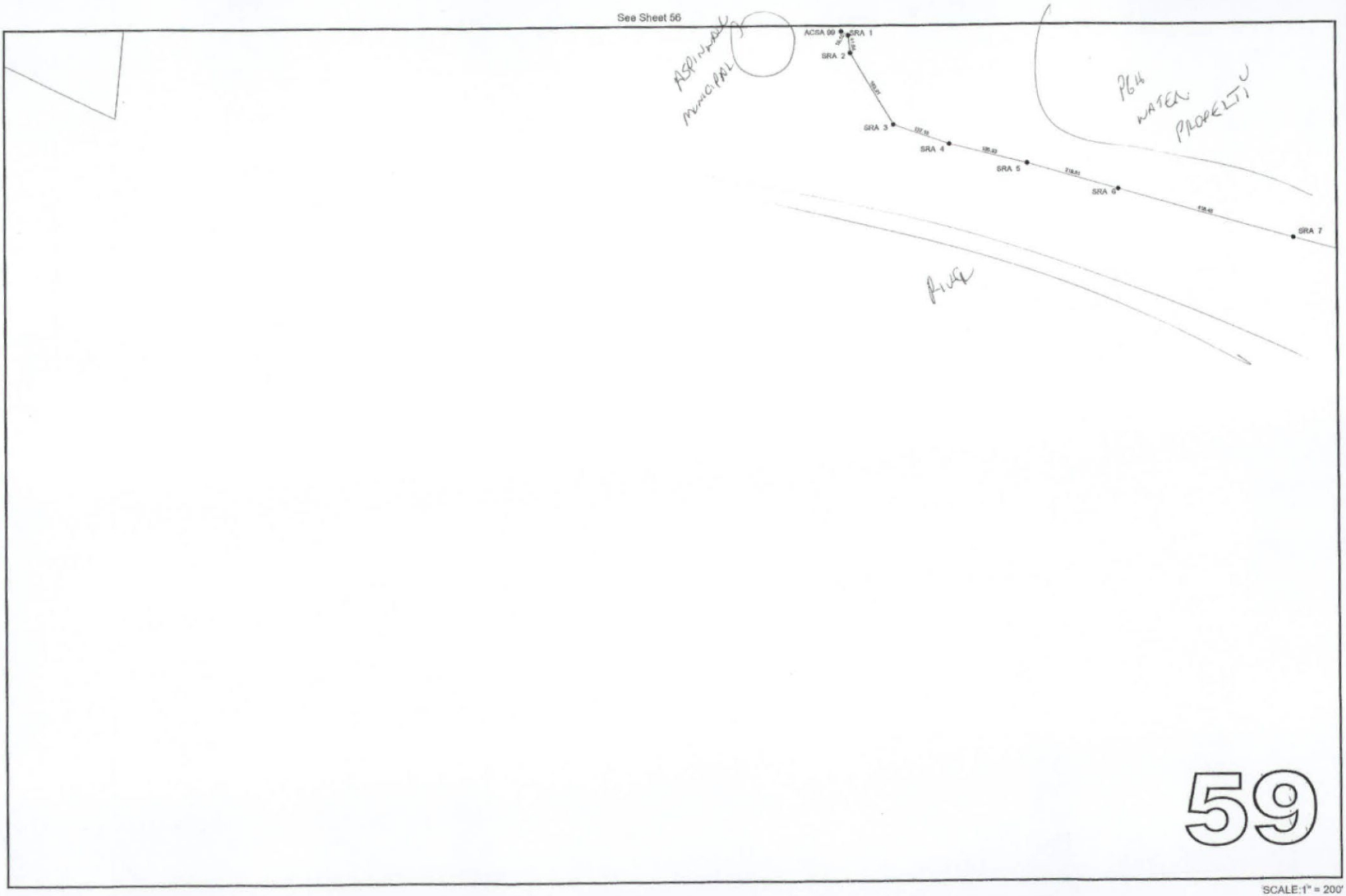
GLENN ENGINEERING & ASSOCIATES LTD.
Registered Engineers — North Huntingdon, PA

Scale: Not to Scale

0'

Date: 1/18/2016

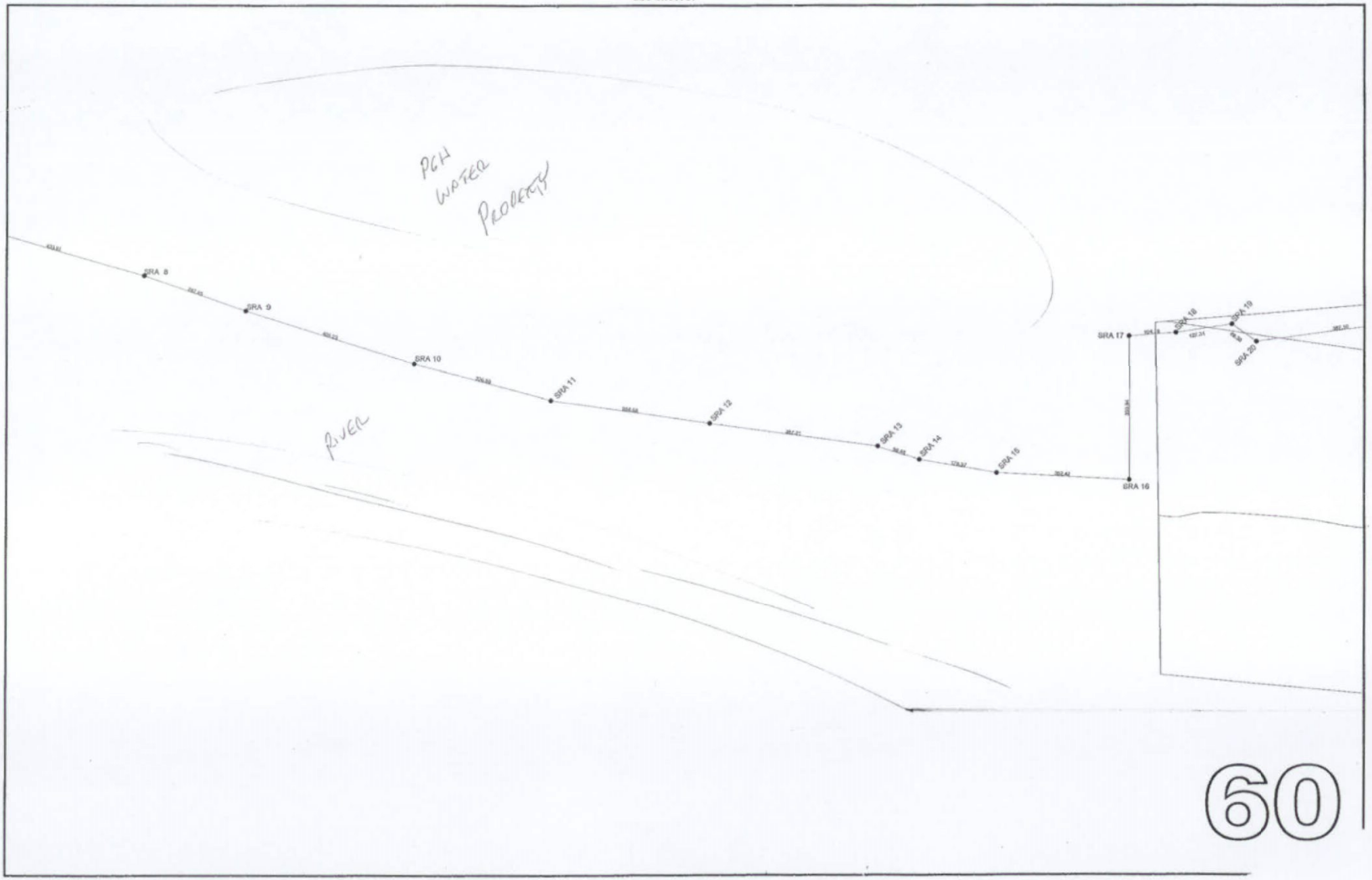
MISC. SEWER LOCATIONS



59

SCALE:1" = 200'

See Sheet 57


PCH
WATER
PROPERTY
RIVER
SRA 8
SRA 9
SRA 10
SRA 11
SRA 12
SRA 13
SRA 14
SRA 15
SRA 16
SRA 17
SRA 18
SRA 19
SRA 20

Exh. RAW/C-16



Borough Boundary
Buildings
Hydrology
Streets
Contours

Manholes
Storm Outfalls
CSO Outfalls
Catchbasins

Combined Sewer
Shaler Sewer
Storm Sewer

Borough of Etna
Sewer Map
F5

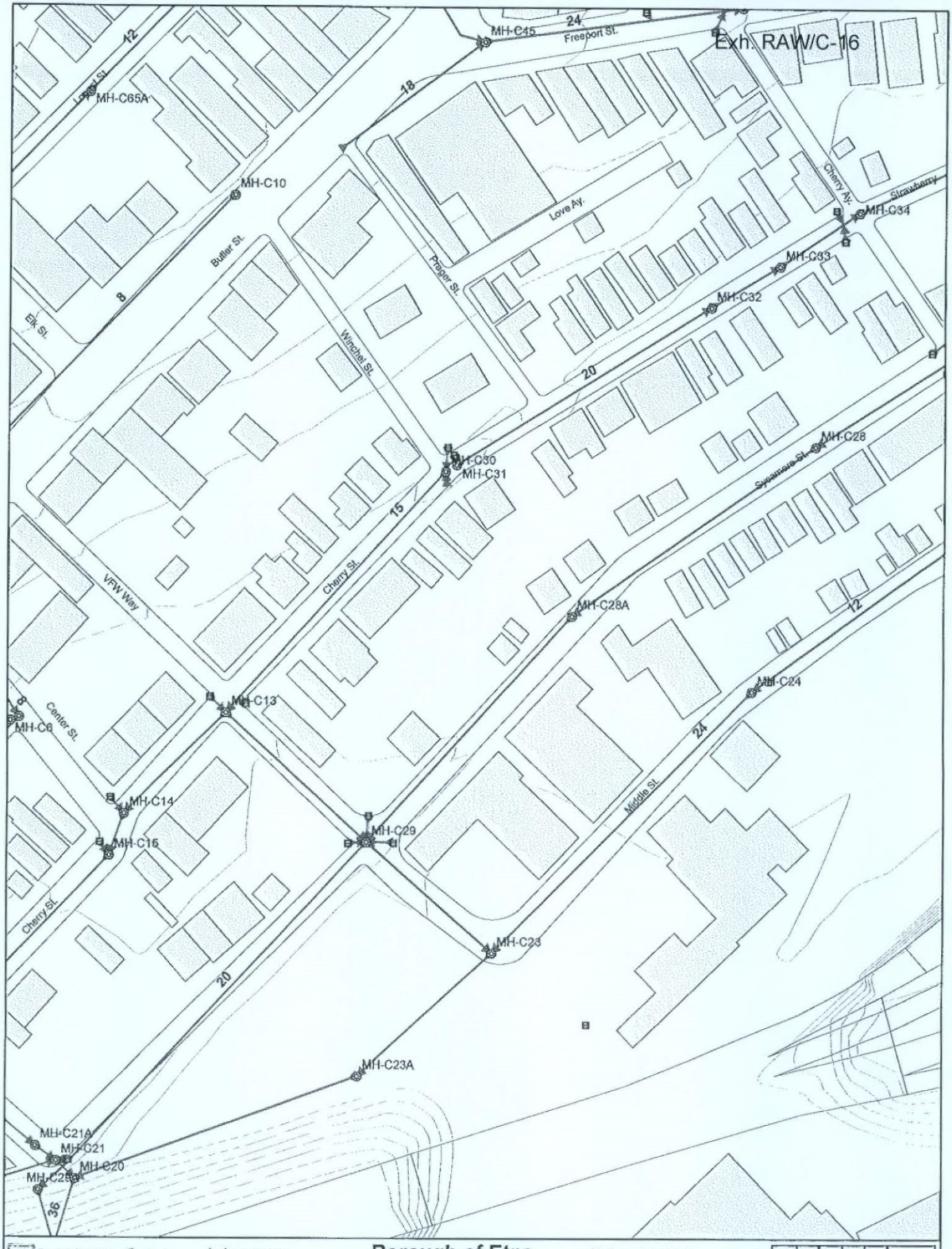
Aug 03, 2007

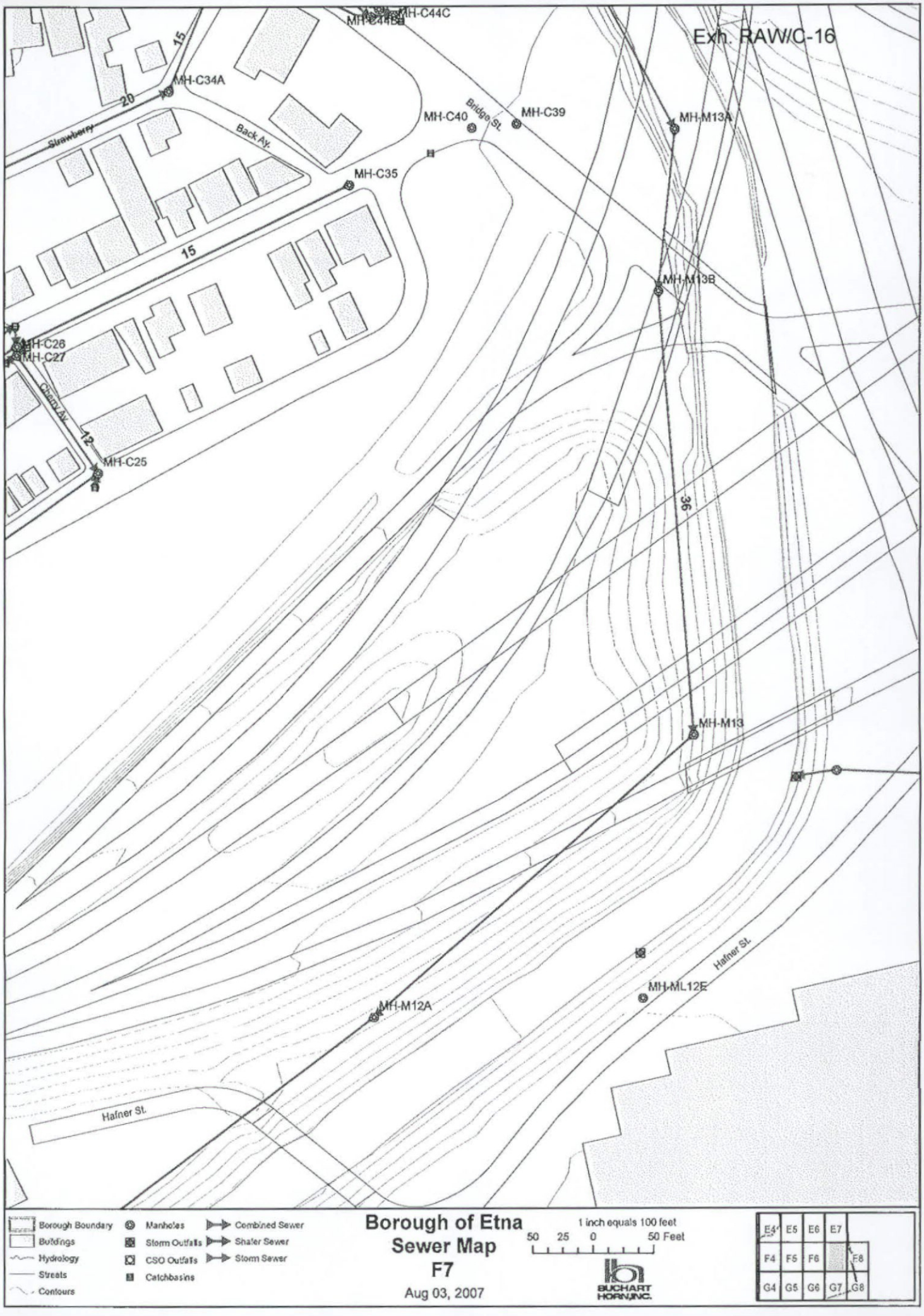
1 inch equals 100 feet
50 25 0 50 Feet

BUCHART HORN INC.

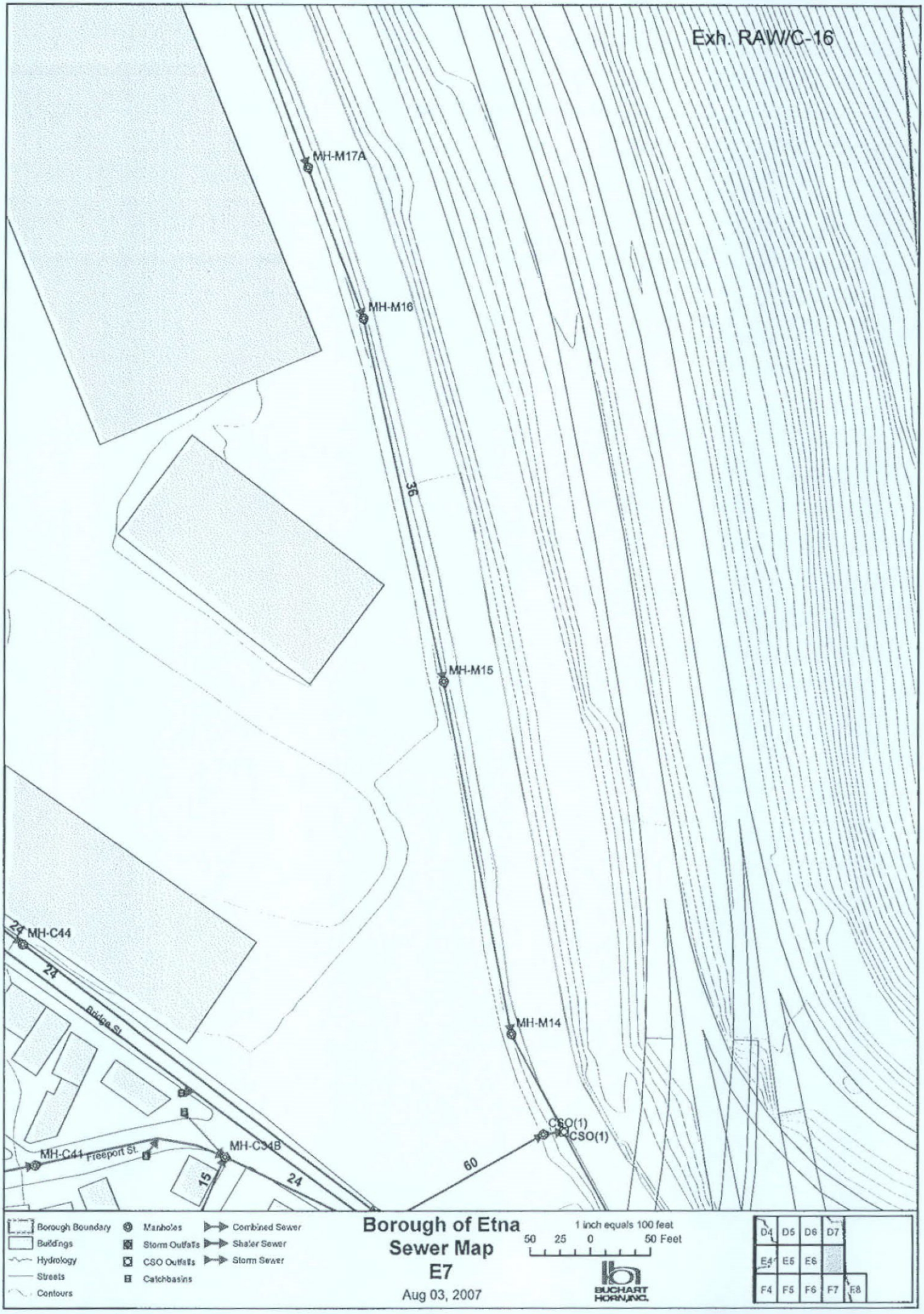
		E4	E5	E6	E7	
F2	F3	F4		F6	F7	F8
G2	G3	G4	G5	G6	G7	G8

Exh. RAW/C-16


MH-C15
24
Freeport St.
12
Lower St.
MH-C65A
18
MH-C10
Butler St.
8
Elk St.
Love Ay.
Prager St.
Cherry Ay.
Strawberry
MH-C34
MH-C33
MH-C32
20
Winchel St.
MH-C28
Sycamore St.
MH-C30
MH-C31
15
Cherry St.
VFW Way
MH-C28A
12
MH-C24
MH-C13
8
MH-C6
Center St.
24
Middle St.
MH-C14
MH-C29
MH-C16
Cherry St.
MH-C23
20
MH-C23A
MH-C21A
MH-C21
MH-C20
MH-C22
36
Borough Boundary
Buildings
Hydrology
Streets
Contours
Manholes
Storm Outfalls
CSO Outfalls
Catchbasins
Combined Sewer
Shaler Sewer
Storm Sewer
Borough of Etna
Sewer Map
F6
Aug 03, 2007
1 inch equals 100 feet
50 25 0 50 Feet
BUCHART HORN, INC.
E4 E5 E6 E7
F3 F4 F5 F7 F8
G3 G4 G5 G6 G7 G8

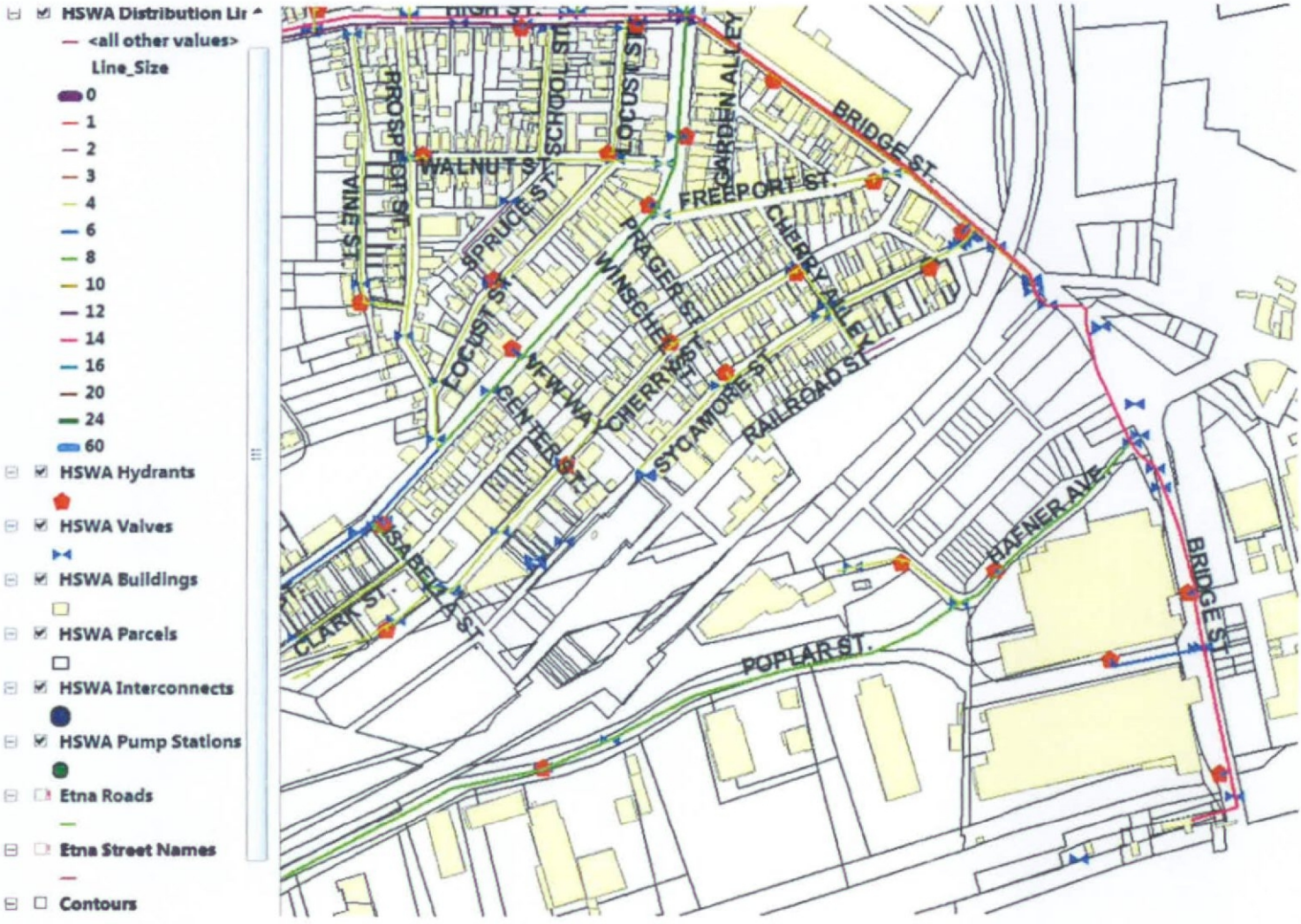

Exh. RAW/C-16
MH-C44C
MH-C44B
MH-C34A
15
20
Strawberry
Back Ay.
MH-C40
Bridge St.
MH-C39
MH-M13A
MH-C35
15
MH-M13B
MH-C26
MH-C27
Cherry Av.
12
MH-C25
36
MH-M13
Hafner St.
MH-ML12E
MH-M12A
Hafner St.
Borough Boundary
Buildings
Hydrology
Streets
Contours
Manholes
Storm Outfalls
CSO Outfalls
Catchbasins
Combined Sewer
Shafer Sewer
Storm Sewer
Borough of Etna
Sewer Map
F7
Aug 03, 2007
1 inch equals 100 feet
50 25 0 50 Feet
BUCHART HORN, INC.
E4 E5 E6 E7
F4 F5 F6 F8
G4 G5 G6 G7 G8

Exh. RAW/C-16


MH-M17A
MH-M16
36
MH-M15
MH-M14
MH-C44
24
24
Bridge St
MH-C44
Freeport St.
MH-C43B
15
24
60
CSO(1)
CSO(1)
Borough Boundary
Buildings
Hydrology
Streets
Contours
Manholes
Storm Outfalls
CSO Outfalls
Catchbasins
Combined Sewer
Sanitary Sewer
Storm Sewer
Borough of Etna
Sewer Map
E7
Aug 03, 2007
1 inch equals 100 feet
50 25 0 50 Feet
BUCHART HORN, INC.
D4 D5 D6 D7
E4 E5 E6
F4 F5 F6 F7 F8


Exh. RAW/C-16
Arlington Ct
Private
Koehler St
Friday St
E Ohio St

Exh. RAW/C-16


HSWA Distribution Lir
<all other values>
Line_Size
0
1
2
3
4
6
8
10
12
14
16
20
24
60
HSWA Hydrants
HSWA Valves
HSWA Buildings
HSWA Parcels
HSWA Interconnects
HSWA Pump Stations
Etna Roads
Etna Street Names
Contours
BRIDGE ST.
FREEPORT ST.
WALNUT ST.
SPRUCE ST.
LOCUST ST.
SCHOOL ST.
GARDEN ALLEY
PINE ST.
PROSPECT ST.
PRAGER ST.
WINSCHELL
CHERRY ALLEY
CHERRY ST.
SYCAMORE ST.
RAILROAD ST.
CENTER ST.
WEWENA
ISABELLA ST.
CLARK ST.
HAFNER AVE.
POPLAR ST.
BRIDGE ST.


HSWA Distribution Li
<all other values>
Line_Size
0
1
2
3
4
6
8
10
12
14
16
20
24
60
HSWA Hydrants
HSWA Valves
HSWA Buildings
HSWA Parcels
HSWA Interconnects
HSWA Pump Stations
Etna Roads
Etna Street Names
PARKER ST.
MANHATTEN AVE.
KOEHLER
KRISS DR.
KOEHLER ST.
SHERMAN
NEWLAND LN.
ELIZABETH ST.
SOLLINGER LN.
FRIDAY RD.


<all other values>
Line_Size
0
1
2
3
4
6
8
10
12
14
16
20
24
60
HSWA Hydrants
HSWA Valves
HSWA Buildings
DAVIS AVE.
G ST.
MT. VERNON DR.
ARLINGTON CT.
HILL ST.
KOEHLER ST.
PARKER ST.
MANHATTEN AVE.
BUCKEYE ST.
NAUMAN ST.
WASHINGTON ST.
KRISS DR.
SHERMAN AVE.
BERTHA ST.
FORSAITH ST.
VINE AVE.
KOEHL
SHERMAN AVE.

Exh. RAW/C-16


ISABELLA ST.
BUTLER ST.
CLARK ST.
PARKER ST.
WASHINGTON ST
HSWA Distribution Lir
<all other values>
Line_Size
0
1
2
3
4
6
8
10
12
14
16
20
24
60
HSWA Hydrants
HSWA Valves

Exh. RAW/C-16

20152580878



Legend

Distribution Mains

Pressure

- High
- Low

Non-Distribution Mains

Type

- Transmission
- Gathering
- Production
- Pipe Casing

150 Feet

1 inch = 600 feet

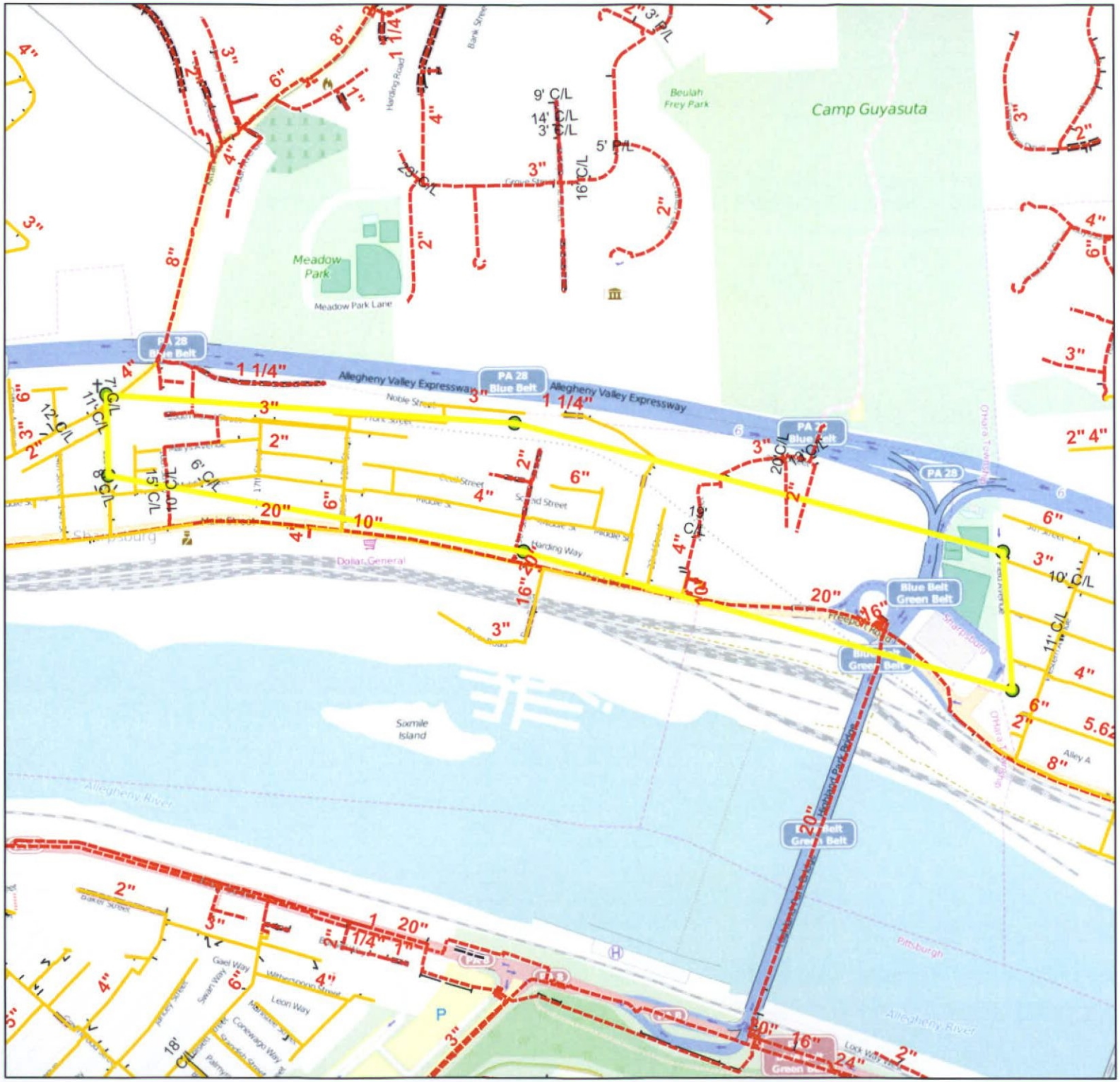
N W E S

This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries.

Date: 9/16/2015

Exh. RAW/C-16

20152580933



Legend

Distribution Mains

Pressure

- High
- Low

Non-Distribution Mains

Type

- Transmission
- Gathering
- Production
- Pipe Casing

150 Feet

1 inch = 800 feet

N W E S

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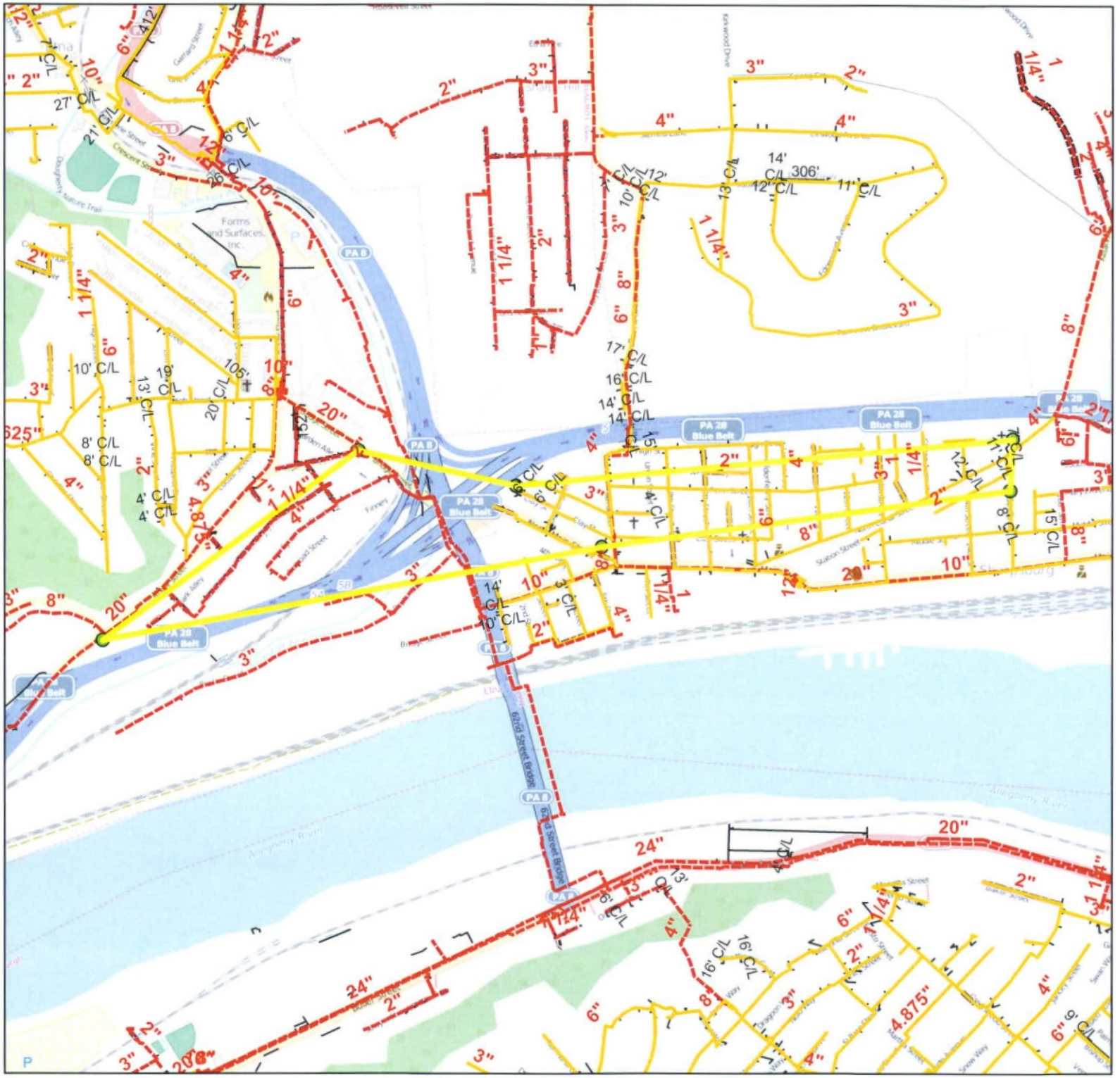
Date: 9/16/2015

Exh. RAW/C-16

20152581040



Legend

Distribution Mains

Pressure

- High
- Low

Non-Distribution Mains

Type

- Transmission
- Gathering
- Production
- Pipe Casing

150 Feet

1 inch = 900 feet

N W E S

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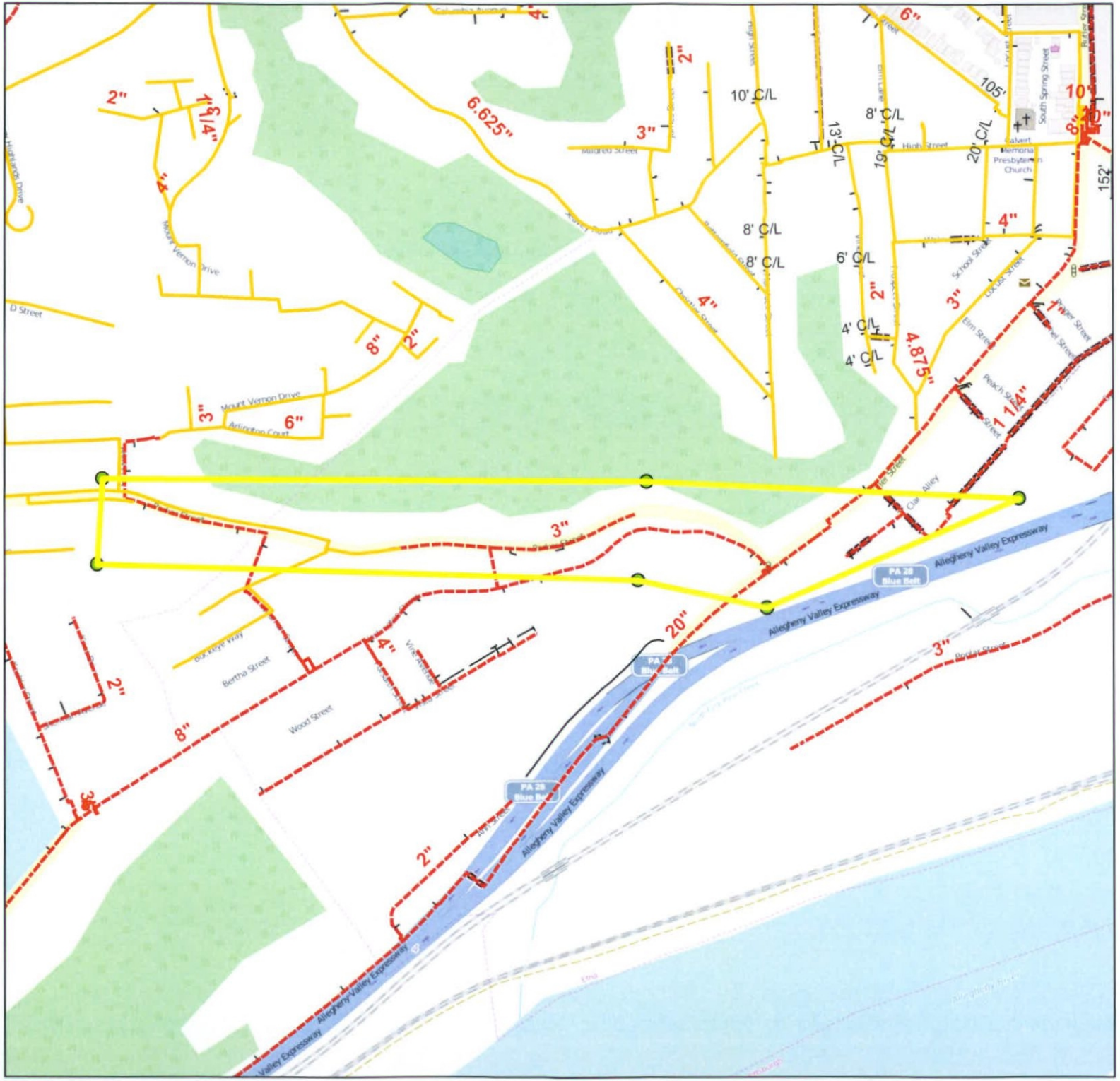
Date: 9/16/2015

Exh. RAW/C-16

20152582279



Legend

Distribution Mains

Pressure

- High
- Low

Non-Distribution Mains

Type

- Transmission
- Gathering
- Production
- Pipe Casing

150 Feet

1 inch = 500 feet

N W E S

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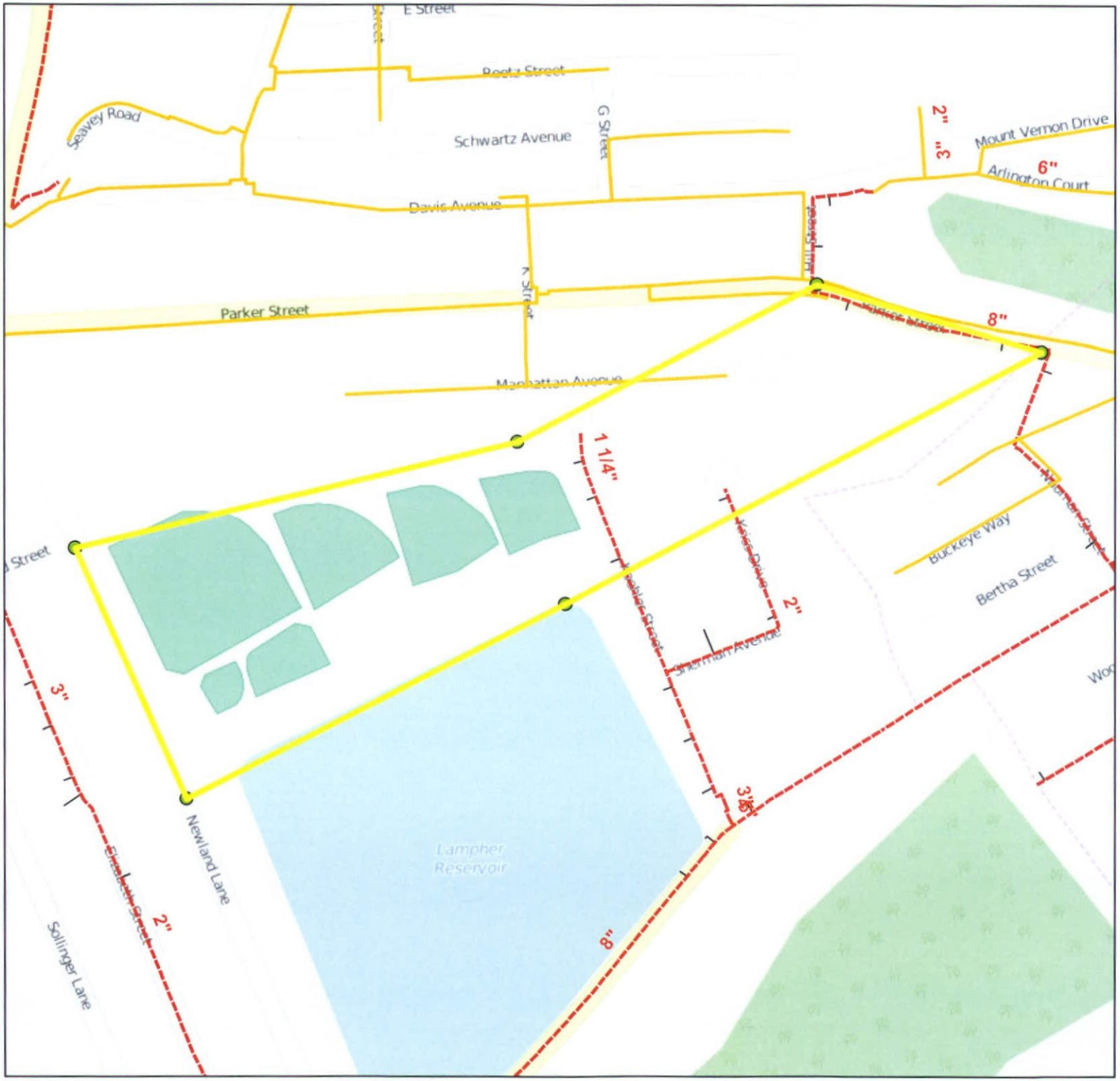
Date: 9/16/2015

Exh. RAW/C-16

20152582357



Legend

Distribution Mains

Pressure

- High
- Low

Non-Distribution Mains

Type

- Transmission
- Gathering
- Production
- Pipe Casing

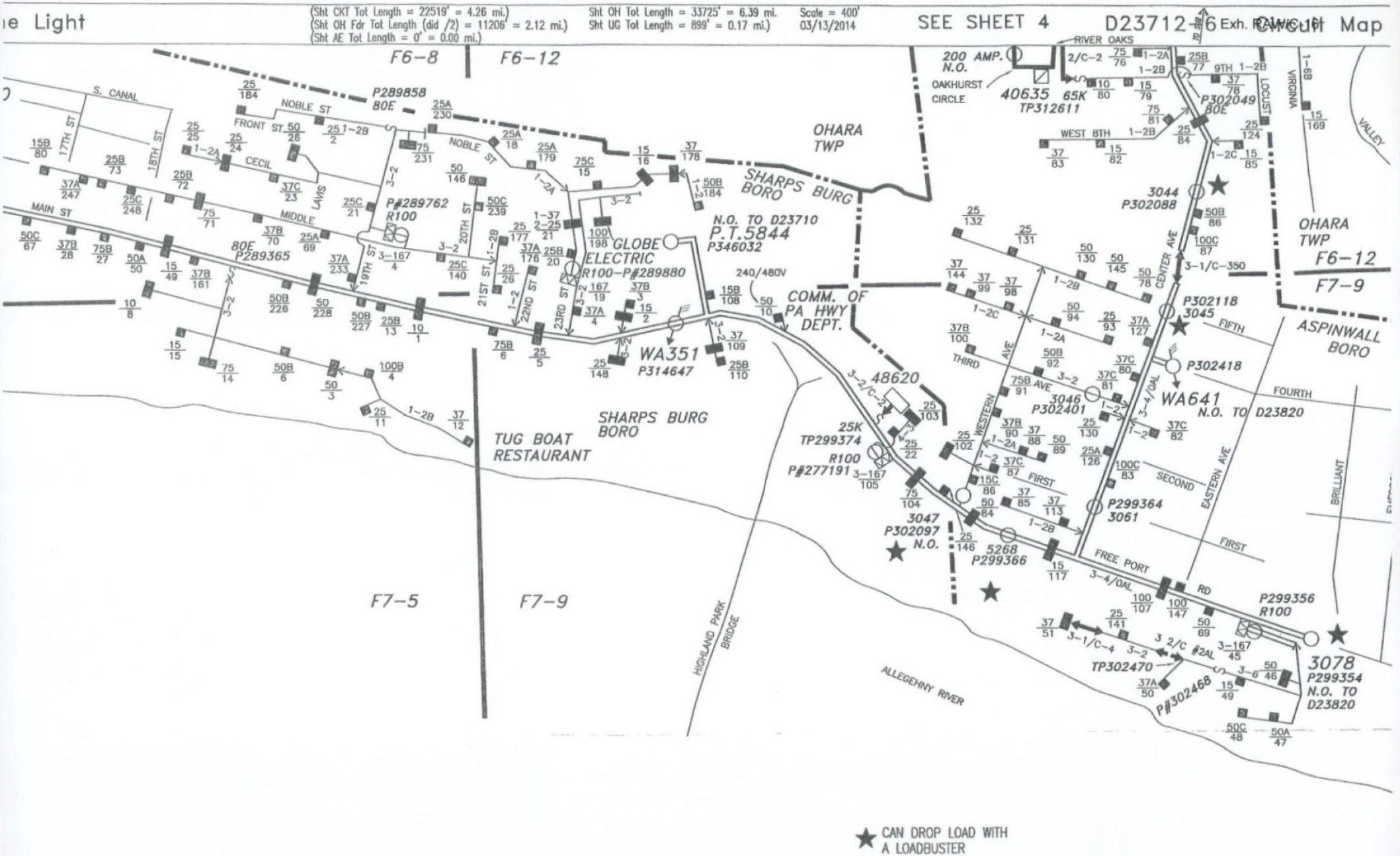
150 Feet

1 inch = 300 feet

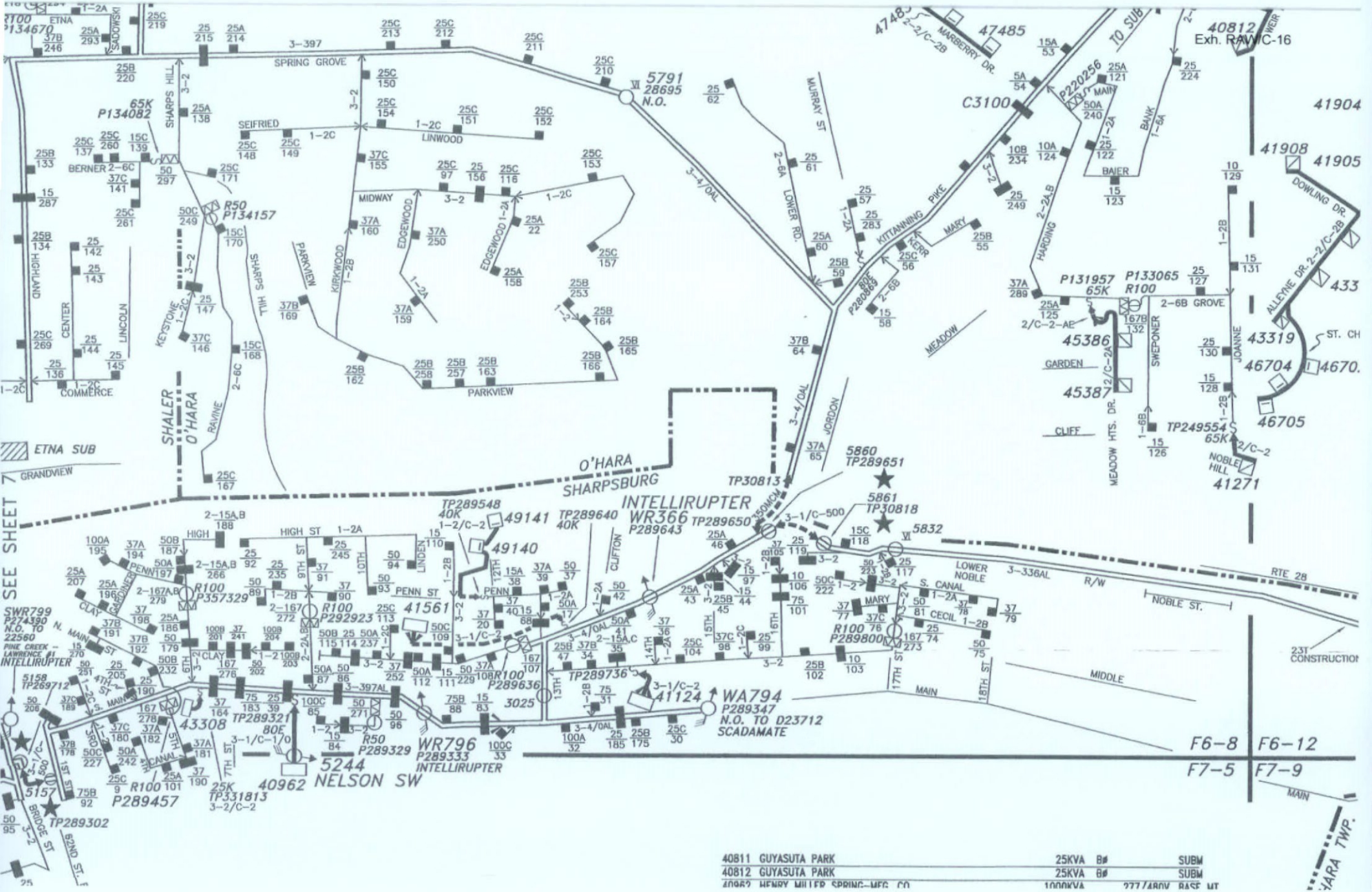
N W E S

This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries.

Date: 9/16/2015



e Light
(Sht CKT Tot Length = 22519' = 4.26 mi.)
(Sht OH Fdr Tot Length (did /2) = 11206' = 2.12 mi.)
(Sht AE Tot Length = 0' = 0.00 mi.)
Sht OH Tot Length = 33725' = 6.39 mi.
Sht UG Tot Length = 899' = 0.17 mi.)
Scale = 400'
03/13/2014
SEE SHEET 4
D23712-6 Exh. RAWIC-16
Circuit Map
F6-8
F6-12
F7-5
F7-9
OHARA TWP
SHARPS BURG BORO
ASPINWALL BORO
TUG BOAT RESTAURANT
GLOBE ELECTRIC
N.O. TO D23710
P.T.5844
P346032
COMM. OF PA HWY DEPT.
WA351
P314647
WA641
N.O. TO D23820
P289858
80E
P289365
80E
P#289762
R100
R100-P#289880
200 AMP.
N.O.
OAKHURST CIRCLE
40635
65K
TP312611
P302049
80E
3044
P302088
P302118
3045
P302418
3046
P302401
48620
25K
TP299374
R100
P#277191
3047
P302097
N.O.
5268
P299366
P299364
3061
P299356
R100
3078
P299354
N.O. TO D23820
TP302470
P#302468
HIGHLAND PARK BRIDGE
ALLEGEHNY RIVER
CAN DROP LOAD WITH A LOADBUSTER


Exh. RAWC-16
40812
41904
41908
41905
41271
SHALER
O'HARA
SHARPSBURG
ETNA SUB
SEE SHEET 7
INTELLIRUPTER
WR366
P289643
5791
28695
N.O.
5860
TP289651
5861
TP30818
5832
TP30813
49141
49140
41561
41124
WA794
P289347
N.O. TO D23712
SCADAMATE
WR796
P289333
INTELLIRUPTER
5244
NELSON SW
40962
43308
5158
TP269712
5157
TP289302
TP289321
TP331813
P289457
P289329
3025
C3100
45386
45387
43319
46704
46705
4670.
433
F6-8
F6-12
F7-5
F7-9
SPRING GROVE
LINWOOD
MIDWAY
PARKVIEW
SEIFRIED
BERNER
HIGHLAND
CENTER
LINCOLN
COMMERCE
SHARPS HILL
KEYSTONE
RAVINE
KIRKWOOD
EDGEWOOD
EDGEWOOD 1-2A
MURRAY ST.
LOWER RD.
KITTANNING PIKE
MARY
MEADOW
JORDON
CLIFTON
HIGH
HIGH ST
PENN
PENN ST
LINDEN
9TH ST
10TH
12TH
13TH
14TH
15TH
16TH
17TH ST
18TH ST
CLAY
GARDINER
N. MAIN ST
S. MAIN ST
4TH ST
6TH
7TH ST
1ST ST
BRIDGE ST
GRAND ST.
LOWER NOBLE
S. CANAL
CECIL
NOBLE ST.
MIDDLE
MAIN
RTE 28
3-336AL R/W
MARBERRY DR.
HARDING
BAIER
BANK
MAIN
GROVE
GARDEN
CLIFF
SWEPONER
WEADOW HTS. DR.
JOANNE
DOWLING DR.
ALLEYNE DR.
NOBLE HILL
TO SUB
23T CONSTRUCTION
SWR799
P274390
N.O. TO 22560
PINE CREEK - LAWRENCE #1 INTELLIRUPTER
TP289548
TP289640
TP289650
TP289736
TP289636
TP289652
TP249554
P220256
P131957
P133065
P134082
P134670
P134157
P357329
P292923
P289800
P289652
P280865
40811 GUYASUTA PARK 25KVA Bø SUBM
40812 GUYASUTA PARK 25KVA Bø SUBM
40982 HENRY MILLER SPRING-MFG CO 1000KVA 277/480V BASE MT

C. Geotechnical information

Exh. RAW/C-16

Hole N°1

736.9	Top Ground	Recovery
Water Level 27.4	Damp Variegated clay & Shale particles of sandstone	
Begin Drill 18.9	17.9 Dry Weathered Grey Shale	
10.07	Medium Grey Shale	1.16'
	Hard " "	5.14'
08.4		

Hole N°2

726.4	Top Ground	Recovery
23.4	Dry Cinders, Slag & Rock Fragments	
20.4	" Sand, Clay, Shale & Sandstone	
17.4	" " " & Sandstone Pcts.	
14.4	" " " " "	
11.4	" Clay & Sandstone Pcts	
Water Level 10.4	08.4 " " " "	
05.4	" " & Shale Pcts	
Begin Drill 03.4	" " & Sandstone Pcts	
00.4	Hard Grey Shale	3.4'
	" " "	4.6'
96.0		
93.8	" " "	1.6'

Hole N°3

737.2	Top Ground	Recovery
34.2	Damp Hard Brown Clay	
Water Level 22.2	Damp Slag	
15.2		
12.2	" Grey Silt	
	Damp Brown & Grey Sand & Gravel (Little Clay)	
Begin Drill 05.7	04.7 Damp Weath Sandstone	
01.2	Hard Grey Sandstone	3.4'

Hole N°4

733.4	Top Ground	Recovery
30.4	Dry Slag Fill	
27.4	Wet " "	
23.4	" " "	
21.4	" " "	
18.4	" " "	
13.4	Moist Silt	
Water Level 11.0	12.4 " Sand & Gravel	
09.4	" " "	
06.4	" " " & Pieces of Sandstone	
03.4	Wet " "	
00.4	" " "	
97.4	" " "	
93.4	" " "	
91.4	" " "	
88.4	" " "	
Begin Drill 85.4	" " "	
82.4	Wet Soft Weath Grey Sandstone	
78.6	" Broken " "	0.8'
76.4	Hard Grey Sandstone	2.0'

DATUM = 670

Hole N°5

734.3	Top Ground	Recovery
31.3	Dry Cinders & Slag	
28.3	" " "	
26.3	" Granulated slag	
22.3	" " "	
19.3	" Cinders & Slag	
16.3	" Silty Clay	
13.3	" Sand & Silty Clay	
Water Level 11.3	10.3 Moist " " "	
07.3	" " " " & Broken Rock	
04.3	" " " "	
01.3	Sandy Clay	
98.3	Moist Sand & Sandy Clay	
95.3	Sand & Sandstone Parts.	
92.3	" " " "	
89.3	Sandy Clay & Sandstone Parts	
86.3	" " " " "	
83.3	" " " " "	
80.8	Brown Sandy Clay, Shale Parts & S.S. Pcts.	
Begin Drill 77.3	" " " " " " "	
73.8	Hard Grey Sandstone	3.5'

Hole N°6

730.9	Top Ground	Recovery
27.9	Dry Cinder Fill	
24.9	" " "	
21.9	" " "	
18.9	" " "	
15.9	" " "	
12.9	Wet Coarse Yellow Sand & Gravel	
Water Level 12.9	09.9 Moist Sand, Gravel & Clay	
06.9	" Silty Sand & Gravel	
03.9	" Clay, Particles of Sand & gravel	
00.9	Wet Sand & Gravel	
97.9	" " "	
94.9	" " "	
91.9	Moist Sandy Clay & Gravel	
Begin Drill 90.9	Moist Sand, Gravel & Pcs Sandstone	
88.9	Sand & Gravel (Cribbed with shale 6/7)	0.0'
	Hard Grey & Brown Sandstone	5.0'
83.9		

Hole N°7

731.1	Top Ground	Recovery
28.1	Moist Cinder Fill & Pcs of wood	
26.1	" " & Silty Fill	
Water Level 22.1	22.1 " " " "	
19.1	Wet " Coal & Sand Fill	
16.1	" " Fill	
13.1	" Brown Sand & Pcs of wood	
Begin Drill 10.1	Moist " " (Gravel	
06.6	Hard Rock (Refusal)	
	Hard Grey Sandstone	4.6'
04.6		
99.6	" " "	4.7'

Hole N°8

730.6	Top Ground	Recovery
27.6	Moist & Concrete - Cinders, Slag & Brick Pcts.	
24.6	Moist Kinney Clay & Shale Pcts	
21.6	" Cinder Fill	
18.6	Wet " "	
15.6	" Clay, Cinders & Shale Pcts	
12.6	" " " " "	
09.6	" Sandy Clay & Sandstone Pcts	
06.6	Moist " " " "	
Water Level 10.6	03.6 Wet Clay, Gravel & " "	
00.6	" " " " "	
97.6	" Sand & Gravel	
94.6	" " "	
91.6	" " " & Shale Pcts	
Begin Drill 88.6	" Sandy Clay & Sandstone Pcts	
87.6	Moist Weath Brown Sandstone	
84.6	Hard " " "	3.0'

DATUM = 670

Note:-
See Sheet 1 for location diagram

PENETRATION

HOLE N°	#1	2	#3	4	5	6	7	8
HAMMER WT	250 LBS			-	24 IN. DROP			
DRIVEN DEPTH	BLOWS		ON		4"	CASING		
1	3	10	16	20	15	33	12	5
2	6	12	8	40	14	20	7	7
3	6	19	6	68	13	18	9	12
4	9	18	65	125	32	15	11	13
5	6	18	45	150	86	100	9	19
6	12	20	61	138	101	12	13	20
7	14	18	17	102	76	6	21	27
8	20	22	10	170	50	6	18	23
9	25	26	11	132	39	6	17	16
10	10	24	13	61	42	9	19	12
11	19	24	9	38	89	9	8	12
12	40	28	30	157	50	6	15	13
13	9	45	25	103	34	5	9	10
14	15	24	17	99	36	5	17	8
15	17	24	11	96	20	6	17	9
16	14	18	25	12	20	7	24	7
17	27	19	45	15	19	9	19	12
18	30	24	75	13	18	28	26	12
19	71	34	54	9	20	31	29	21
20		58	58	9	31	30	32	30
21		86	32	21	34	93	52	36
21.5								
22		64	14	47	33	27	115	33
23		138	7	34	34	25		35
24			9	37	36	26		55
25			9	30	34	42		46
26			14	29	40	30		108
27			10	31	42	42		27
28			19	88	35	7		21
29			15	27	46	9		22
30			9	34	87	15		16
31			23	28	51	36		50
32			75	27	58	30		53
33			64	32	58	20		31
34			62	48	50	50		51
35			38	50	53	30		41
36			22	47	59	40		32
37			43	40	59	59		46
38			30	38	64	50		51
39			17	37	68	82		62
40			15	32	109	120		30
41			24	36	114			45
42			26	31	111			47
43			33	59	30			80
44			36	31	39			
45			39	39	44			
46			30	34	61			
47			26	37	69			
48			19	40	64			
49			16	70	38			
50			19	40	39			
51			29	41	43			
52				147	72			
52.5			70	—	—			
53					66			
54					81			
55					93			
56					100			
57					128			

* 380 lb. Hammer - 30" Drop

TEST BORINGS
ON
ALLEGHENY RIVER EXPRESSWAY
STATE ROUTES 70 & 72
FOR
PENNSYLVANIA DEPARTMENT OF HIGHWAYS

G.S. RICHARDSON
CONSULTING ENGINEER
PITTSBURGH, PA.
SCALE: HORZ 1"=50', VERT 1"=10'

HARRY C. TINNEY
DRILLING CONTRACTOR
GRAFTON, W. VA.
JAN, 1953

00014

SHEET 3 OF 25

DWG. NO. S-1901

Exh. RAW/C-16

Hole N°9

			Recovery
	731.7	Top Ground	
Water Level 727.7	728.7	0.3' Concrete - Moist Brown Silty Clay & Rock Frgts.	
	725.7	Moist Brown Clay & Shale Frgts.	
	724.7	" " Silty Clay	
	719.7	" " " "	
	718.7	" " " "	
	717.7	" " " "	
	716.7	Wet Brown Sand & Sandstone Frgts	
Begin Drill	711.7	Dry Gray Sandy Shale	
	710.7	" " " "	0.6'
	709.1	Hard Broken Limey Shale & Sandstone Rock	1.6'
	707.5	Hard Gray Sandy Shale - Broken	
	705.7	" " " " - Water Stained	2.8'
	703.7	" " Sandstone	2.0'

DATUM = 690

Hole N°10

			Recovery
	710.8	Top Ground	
	677.8	Dry Brick Pavement & Granulated Slag	
	668	" " " " "	
	658	" Red Clay with Shale Frgts	
	638	" " " " "	
	558	" " " " "	
	528	" Brown Shaley Clay & Sandstone Frgts	
Water Level 498	498	" Red Clay with Shale Frgts	
	468	" " " " "	
	438	" " " " "	
	408	" " " " "	
	378	" " " " "	
	348	" " " " "	
	318	" " " " "	
	288	Moist Fine Silty Sand	
	258	" Red clay with Shale Frgts	
	228	" " " " "	
	198	" " " " "	
	168	Wet Fine Silty Sand	
Begin Drill	158	Moist Clayey Shale	
	148	Dry Gray Clayey Shale	
	128	Hard Gray Sandy Shale	2.6'

DATUM = 710

Hole N°11

			Recovery
	806.2	Top Ground	
	802	Dry Top Soil & Weath Shale	
Begin Drill	799.2	" Weath Shale & Clay	
	794.2	Soft Broken Brown Sandy Shale	1.1'
	789.2	" " " " "	2.1'
	784.2	" " " Seamy - Some Clay	1.0'
	783.2	" " " " " - Vert Seams	1.0'
	778.2	Med " " Sandy Seamy Shale	1.5'
	768.2	Hard " " Seamy Shale - Vert Seams	2.6'
	764.2	" Brown Sandy Shale with Thin Sandstone	4.3'
	759.2	" Gray Sandy Shale	5.0'
	754.2	Med " " " & Clay Seams Broken	4.2'
Water Level 753.8	749.2	Hard Dark Gray Shale	5.0'
	744.2	" Gray Sandy Shale & Traces of Sandstone	4.8'
	739.2	" " Sandy Shale	4.7'
	734.2	" " " "	4.1'
	730.0		

DATUM = 720

Hole N°12

			Recovery
Begin Drill	748.0	Top Ground	
	745.0	Med Brown Broken Sandy Shale with Seams	2.7'
	742.0	" " " " " - Thin Layers	2.5'
	737.0	" " " " " " "	4.2'
Water Level 736.0	732.0	" " " " " " "	4.5'
	727.0	Hard Gray Sandy Shale with Seams	4.1'
	726.0	" " " "	2.0'

Hole N°13

			Recovery
	799.60	Top Ground	
	796.60	Moist Brown Clay & Shale Frgts	
	793.60	" " " " "	
	788.60	" " " " "	
	783.60	Dry " " " "	
	778.60	" " " " "	
Begin Drill	773.60	" " " " "	
Water Level 80.60	770.80	Soft Brown Shaley Clay - Indurated	2.1'
	766.60	Med Hard Brown Shaley Clay water Stained	2.3'
	761.60	Med Hard Gray Shale - water Stained Broken	4.5'
	758.10	" " " " " " "	2.5'

DATUM = 760

Hole N°14

			Recovery
	748.7	Top Ground	
	740.7	Dry Ashes, Clay & Pcs of Stone - Loose	
	737.7	Dry Clay, Shale & Sandstone Frgts - Loose	
	734.7	" Pcs of Shale " - Loose	
	731.7	" " " " Some Clay	
	726.7	Dry Broken Sandy Shale	
Begin Drill	723.7	Hard Gray Sandstone	3.0'
Water Level 726.7	721.7	" " "	2.8'
	719.7	" " " - Broken	2.8'

DATUM = 710

Note:-
See Sheet 1 for location diagram

PENETRATION

HOLE N°	9	10	11	12	13	14
HAMMER WT	250 LBS		—		24 IN DROP	
DRIVEN DEPTH	BLOWS	ON	4"		CASING	
1	15	10	5		35	9
2	7	12	5		37	13
3	9	12	17		47	22
4	19	15	20		37	18
5	27	9	22		36	16
6	32	9	27		29	15
7	41	10			17	12
8	21	10			25	14
9	19	11			47	18
10	17	15			60	17
11	27	18			70	15
12	31	26			135	12
13	30	15			27	100
14	29	21			29	
15	26	31			219	
16	13	28			243	
17	19	31				
18	21	34				
19	17	18				
20	17	19				
21	23	36				
22	10	19				
23	25	20				
24	81	32				
24.5	189	...				
25		60				
26		73				
27		96				
28		82				
29		107				
30		96				
31		50				
32		45				
33		72				
34		67				
35		86				
36		113				
37		62				
38		47				
39		58				
40		47				
41		60				
42		79				
43		33				
44		39				
45		56				
46		47				
47		53				
48		52				
49		66				
50		64				
51		85				
52		84				
53		80				
54		102				
55		93				
56		99				
57		97				
58		132				

TEST BORINGS
ON
ALLEGHENY RIVER EXPRESSWAY
STATE ROUTES 70 & 72
FOR
PENNSYLVANIA DEPARTMENT OF HIGHWAYS

G.S. RICHARDSON
CONSULTING ENGINEER
PITTSBURGH, PA.
SCALE: HORIZ, 1"=50', VERT 1"=10'

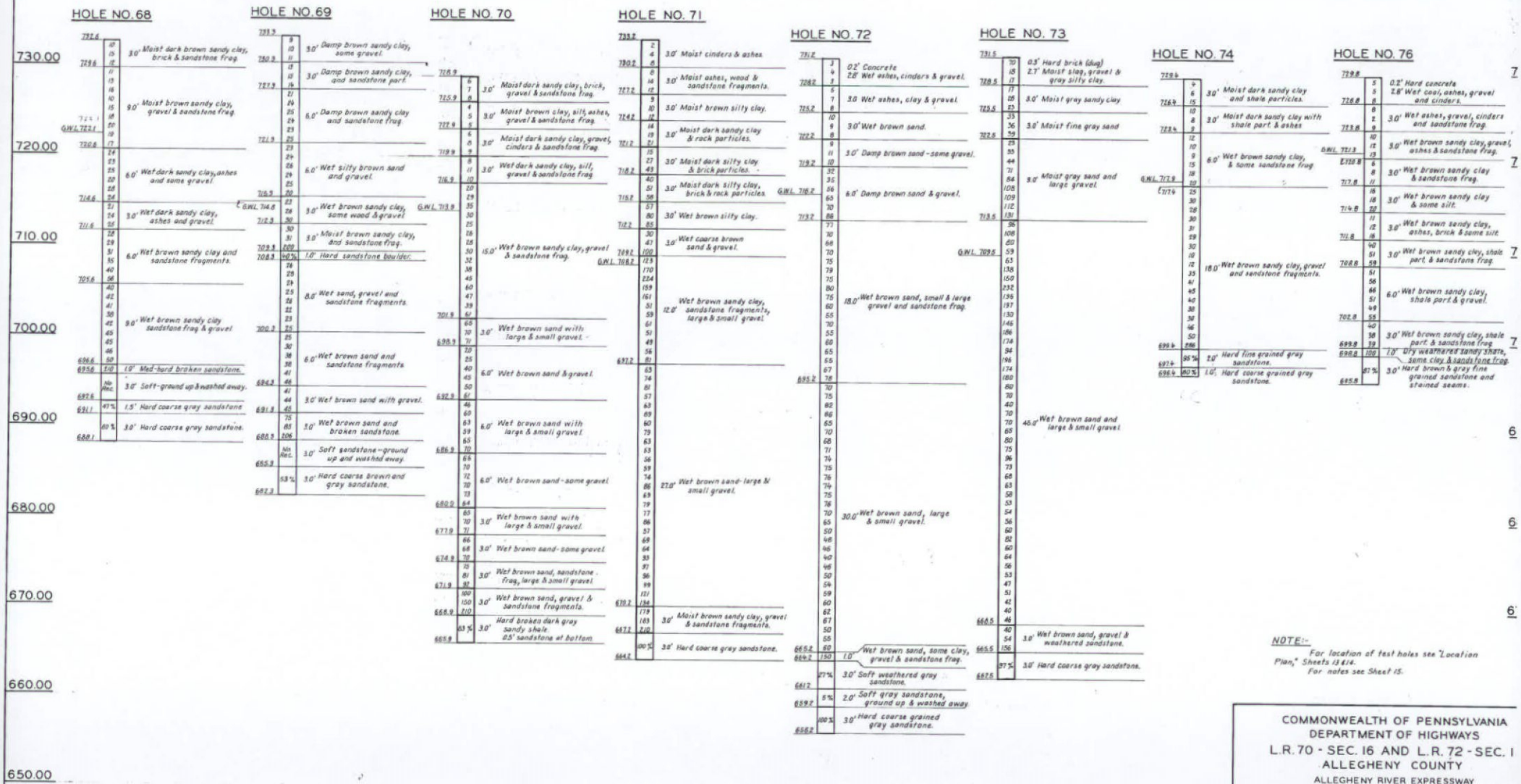
HARRY C. TINNEY
DRILLING CONTRAC
GRAFTON, W. VA.
JAN, 1951

0001495

SHEET 4 OF 25

DWG. NO. S-1901

Exh. RAW/C-16



NOTE:-
For location of test holes see "Location Plan," Sheets 13 & 14.
For notes see Sheet 15.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
L.R. 70 - SEC. 16 AND L.R. 72 - SEC. 1
ALLEGHENY COUNTY
ALLEGHENY RIVER EXPRESSWAY

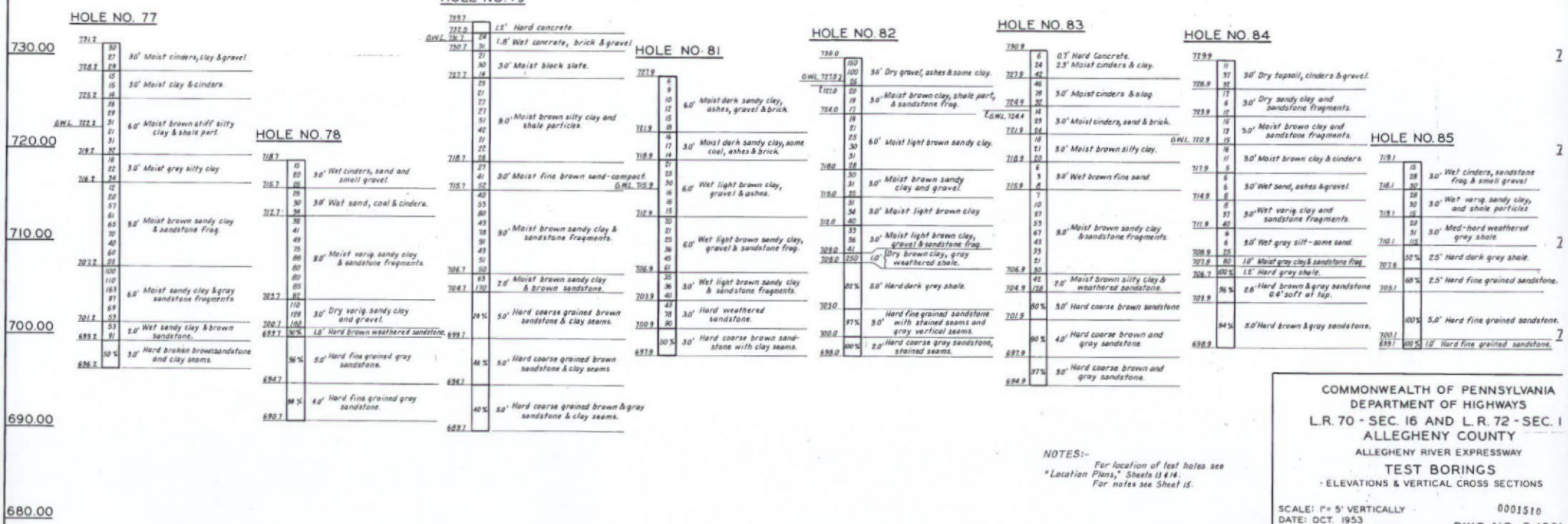
TEST BORINGS

ELEVATIONS & VERTICAL CROSS SECTIONS

SCALE: 1"=5' VERTICALLY
DATE: OCT. 1953
SHEET 19 OF 25
0001509
DWG. NO. S-1901

GEORGE S. RICHARDSON, CONSULTING ENGINEER, PITTSBURG
HARRY C. TINNEY, DRILLING CONTRACTOR, GRAFTON,

Exh. RAW/C-16



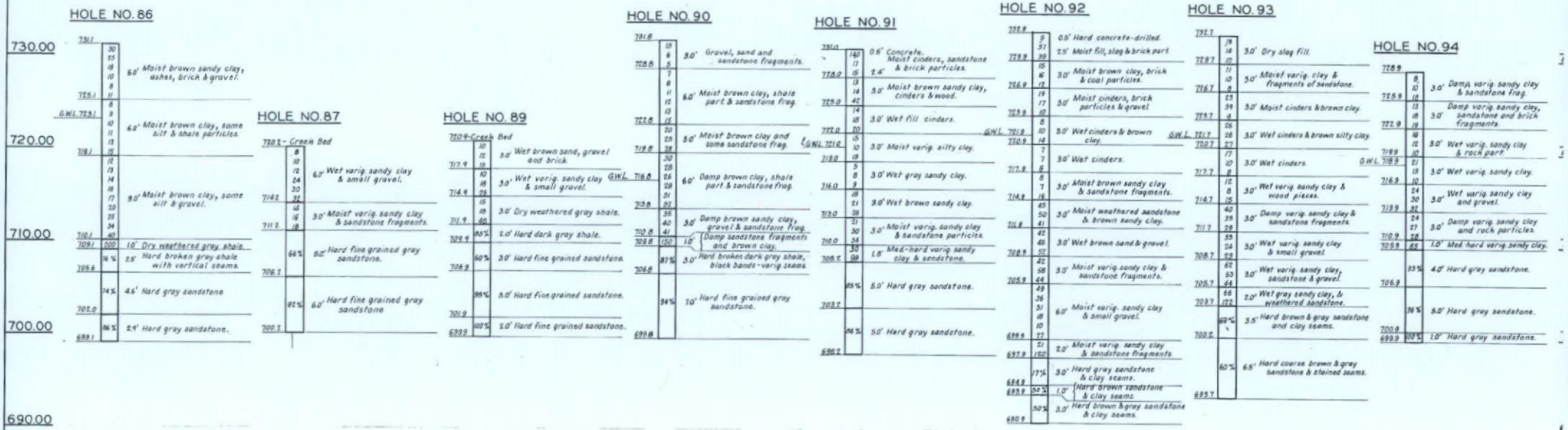
NOTES:-
For location of test holes see "Location Plans," Sheets 13 & 14.
For notes see Sheet 15.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
L.R. 70 - SEC. 16 AND L.R. 72 - SEC. 1
ALLEGHENY COUNTY
ALLEGHENY RIVER EXPRESSWAY
TEST BORINGS
- ELEVATIONS & VERTICAL CROSS SECTIONS

SCALE: 1" = 5' VERTICALLY
DATE: OCT. 1953
SHEET 20 OF 25
0001510
DWG. NO. S-1901

GEORGE S. RICHARDSON, CONSULTING ENGINEER, PITTSBURG
HARRY C. TINNEY, DRILLING CONTRACTOR, GRAFTON,

Exh. RAW/C-16



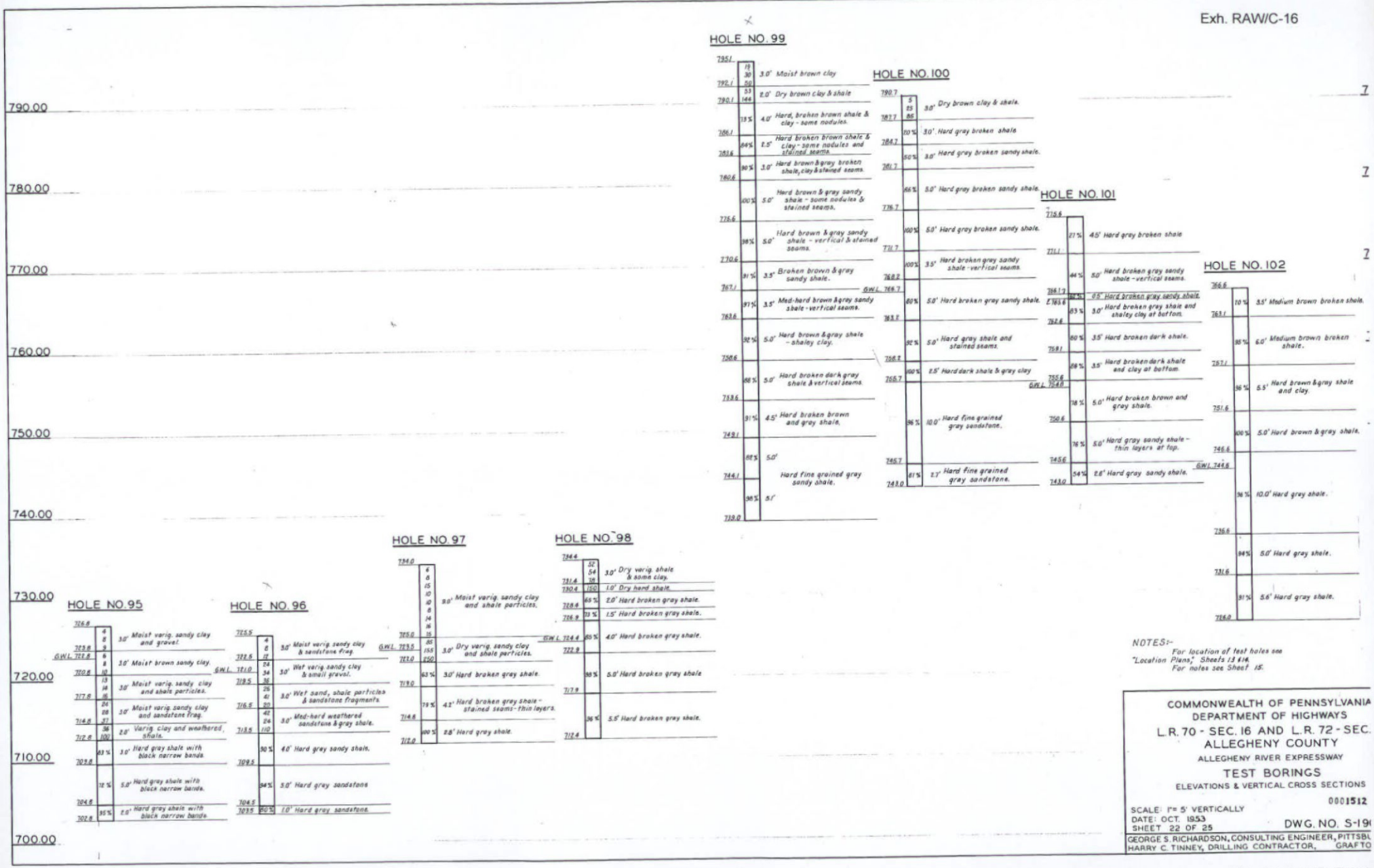
NOTES:-
For location of test holes see "Location Plans," Sheets 13 & 14.
For notes see Sheet 15.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
L.R. 70 - SEC. 16 AND L.R. 72 - SEC. 1
ALLEGHENY COUNTY
ALLEGHENY RIVER EXPRESSWAY
TEST BORINGS
ELEVATIONS & VERTICAL CROSS SECTIONS

SCALE: 1" = 5' VERTICALLY
DATE: OCT. 1953
SHEET 21 OF 25
0001511
DWG. NO. S-1901

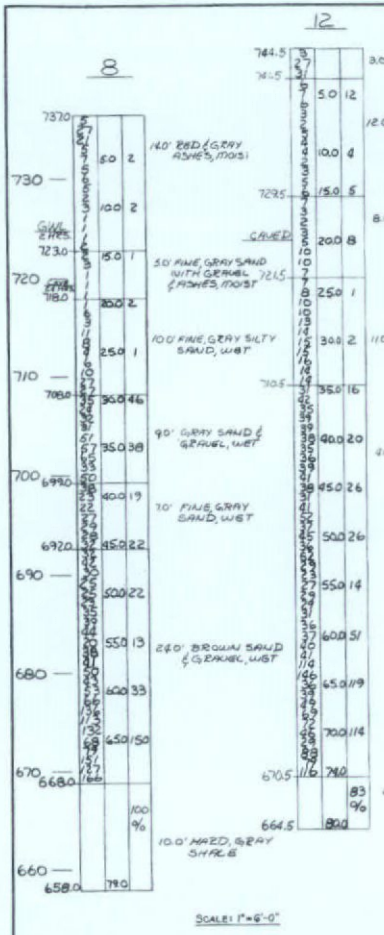
GEORGE S. RICHARDSON, CONSULTING ENGINEER, PITTSBUR
HARRY C. TINNEY, DRILLING CONTRACTOR, GRAFTON,

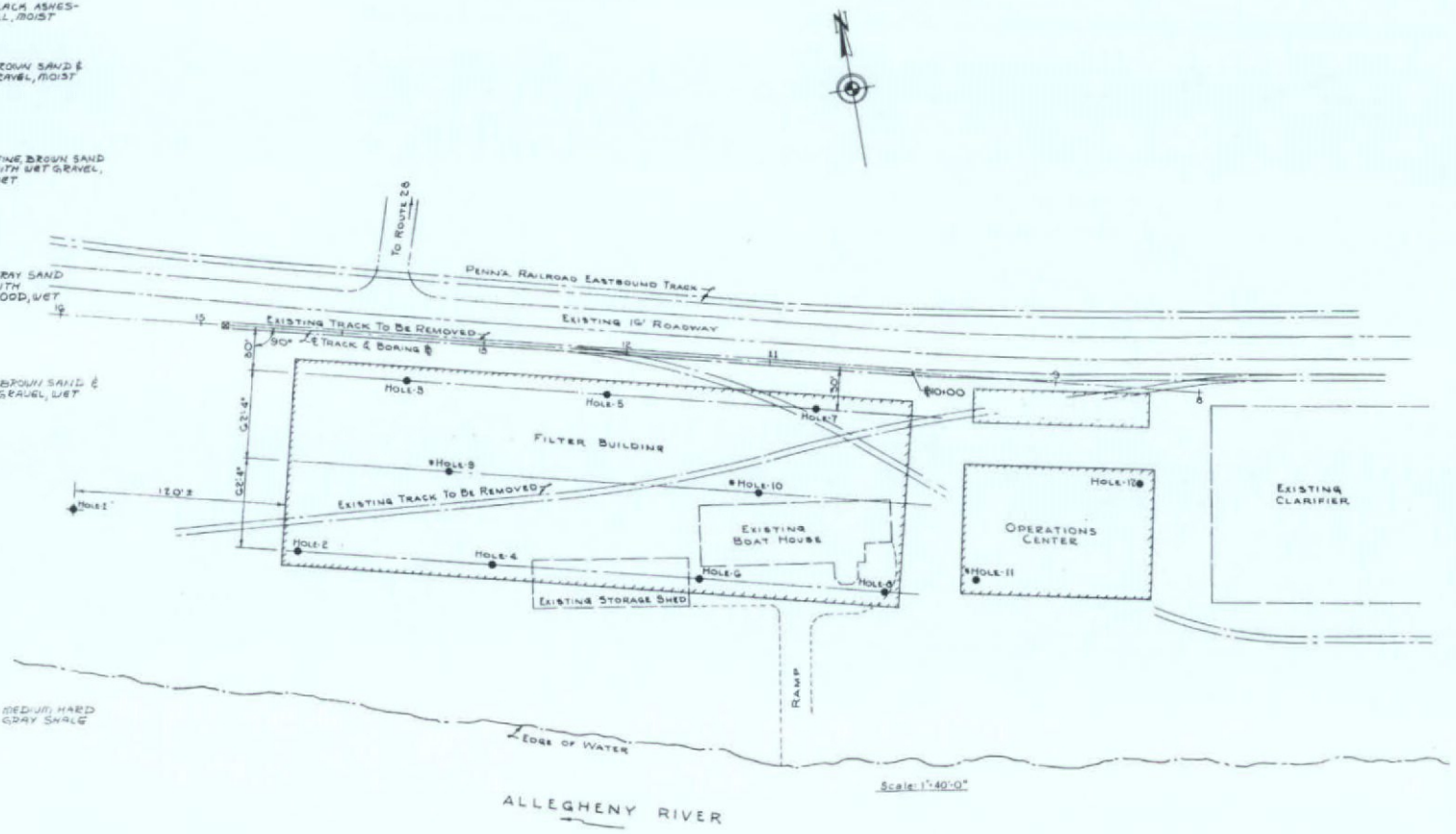
Exh. RAW/C-16



NOTES:-
For location of test holes see "Location Plans," Sheets 13 & 14.
For notes see Sheet 15.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
L.R. 70 - SEC. 16 AND L.R. 72 - SEC.
ALLEGHENY COUNTY
ALLEGHENY RIVER EXPRESSWAY
TEST BORINGS
ELEVATIONS & VERTICAL CROSS SECTIONS
0001512
SCALE: 1" = 5' VERTICALLY
DATE: OCT. 1953
SHEET 22 OF 25
DWG. NO. S-19
GEORGE S. RICHARDSON, CONSULTING ENGINEER, PITTSBU
HARRY C. TINNEY, DRILLING CONTRACTOR, GRAFTO





SCHEDULE OF CORE BORING LOCATIONS		
HOLE Nº	STATION	DISTANCE
1	15+51	154.6 Tℓ Lt.
2	14+21	154.6 Tℓ Lt.
3	13+52	30' Lt.
4	12+84	154.6 Tℓ Lt.
5	12+12	30' Lt.
6	11+58	154.6 Tℓ Lt.
7	10+96	30' Lt.
8	10+09	154.6 Tℓ Lt.
* 9	13+18	92.55 Lt.
*10	11+01	92.55 Lt.
*11	9+47	149' Lt.
12	8+87	67' Lt.

* Holes Nº 9, Nº 10, & Nº 11 Omitted

GENERAL NOTES

The Information Shown On The Boring Records Relative To The Character Of The Sub-Surface Material Has Been Secured For The Exclusive Use Of The City Of Pittsburgh In Designing The Project. There Is No Expressed Or Implied Agreement That The Depths Or The Character Of The Material Have Been Correctly Indicated And Bidders Shall Take Into Account The Possibility That Conditions Affecting The Cost On Quantities Of Work To Be Done May Differ From Those Indicated.

TEST BORINGS

Made By
PENNSYLVANIA DRILLING CO.
Date: Mar. 1963

AS BUILT DRAWING
APR 13 1970

"This Project Was (89-1-00) Num."

REVISED

SWINDELL-DRESSLER CO.
ENGINEERS
PITTSBURGH, PA.
DWG. NO. 4289-H20

DEPARTMENT NO. 1535
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN & CONSTRUCTION

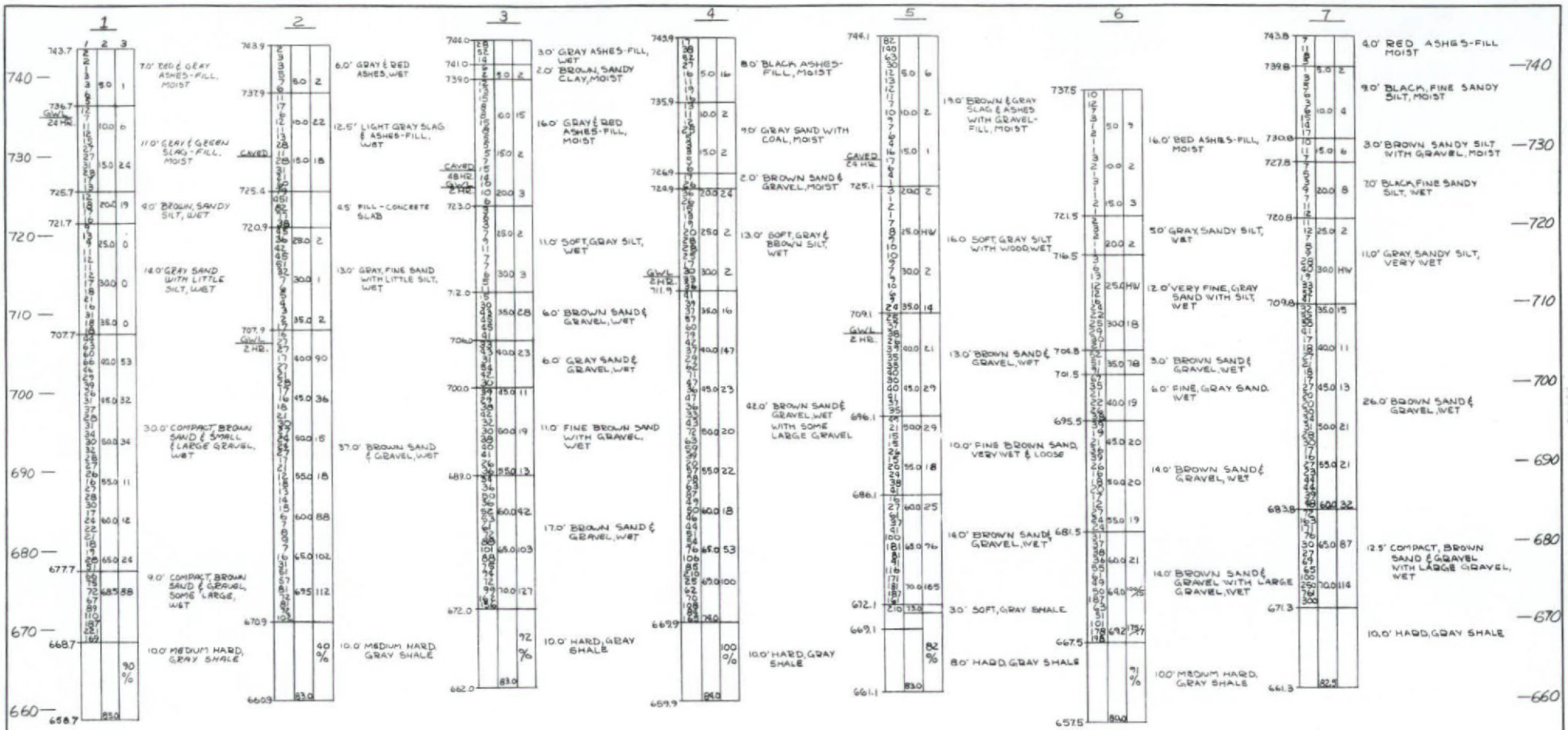
RAPID SAND WATER FILTRATION PLANT

BORING LOCATION PLAN

SCALE: AS NOTED
DATE: NOV. 1964
SHEET 3 OF 122 SHEETS
CONTRACT NO. 1-GENERAL

WF 1240

DR. P.S.B. TR. CH'K'D.



LEGEND

COLUMN 1: BLOWS PER FOOT ON 4" O.D. CASING USING 380 LB. HAMMER DROPPING 30"

COLUMN 2: SAMPLE DEPTH

COLUMN 3: BLOWS PER FOOT ON 2" O.D. SAMPLER USING 140 LB. HAMMER DROPPING 30" & PERCENT OF CORE RECOVERED

GWL : GROUND WATER LEVEL READING

AS BUILT DRAWING
APR 13 1970

CDA PROJECT NO. 02-1-00104

REVISED

SWINDELL-DRESSLER CO.
ENGINEERS
PITTSBURGH, PA.
DWG. NO. 4289-H21

DEPARTMENT NO. 1535
CITY OF PITTSBURGH
DEPARTMENT OF WATER
DIVISION OF DESIGN & CONSTRUCTION

RAPID SAND WATER FILTRATION PLANT

BORING RECORD

SCALE: 1" = 6'-0"
DATE: NOV. 1964
SHEET 4 OF 122 SHEETS
CONTRACT NO. 1-GENERAL

WF 1241

DR. PSB. TR. CH'K'D.

D. Hydraulic model data

Figure 1 - Existing Rising Mains

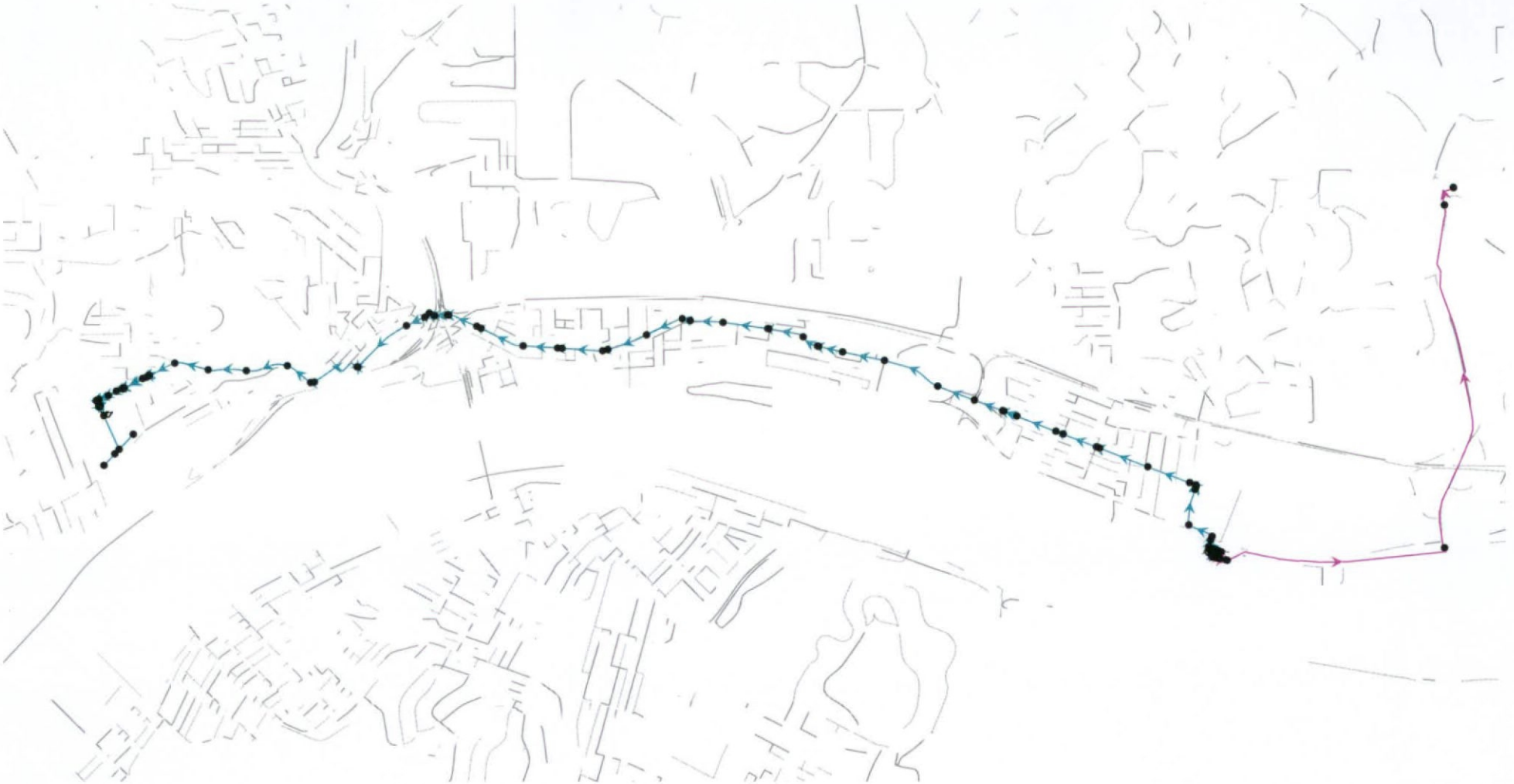


Figure 2 - Existing And New Rising Mains

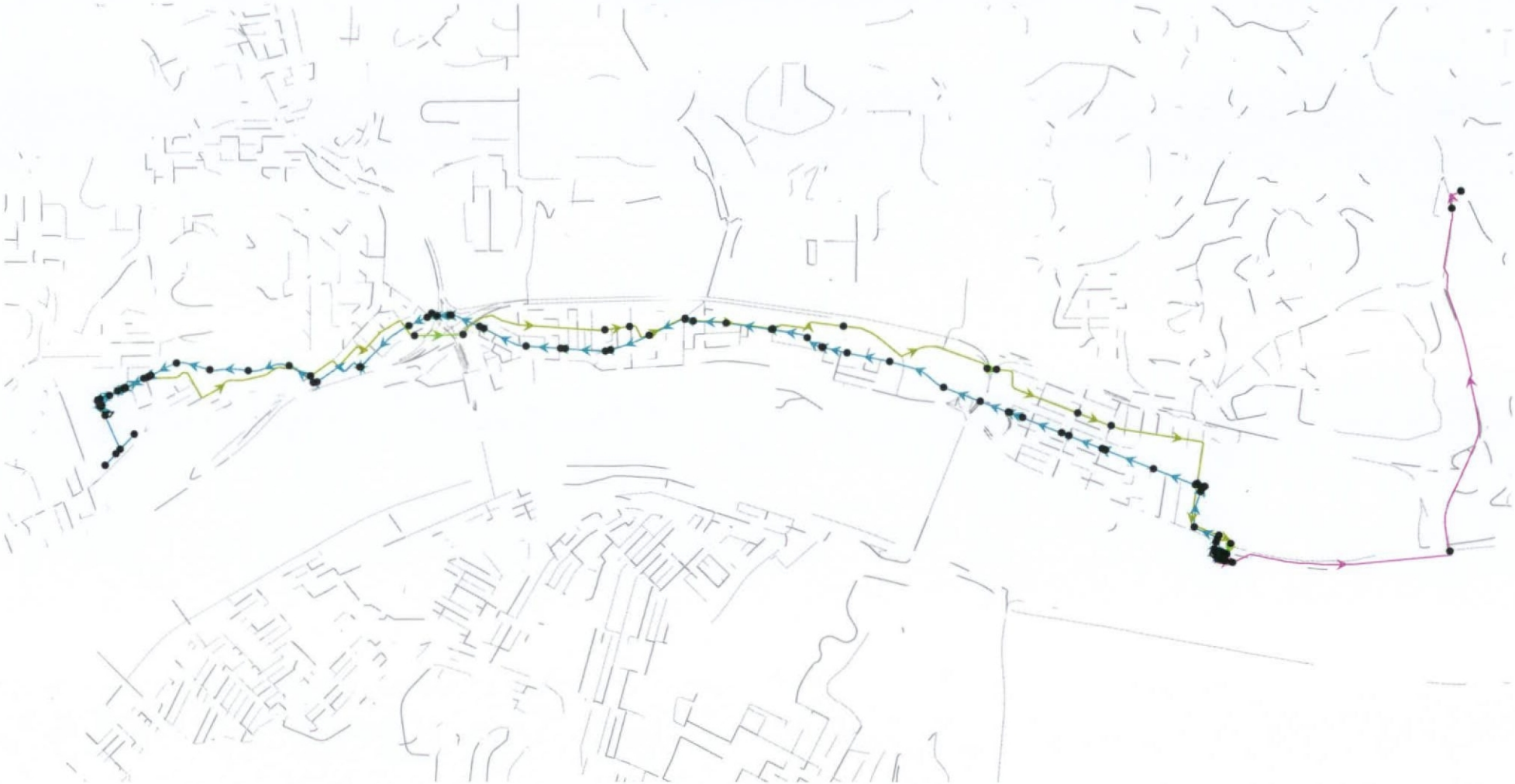
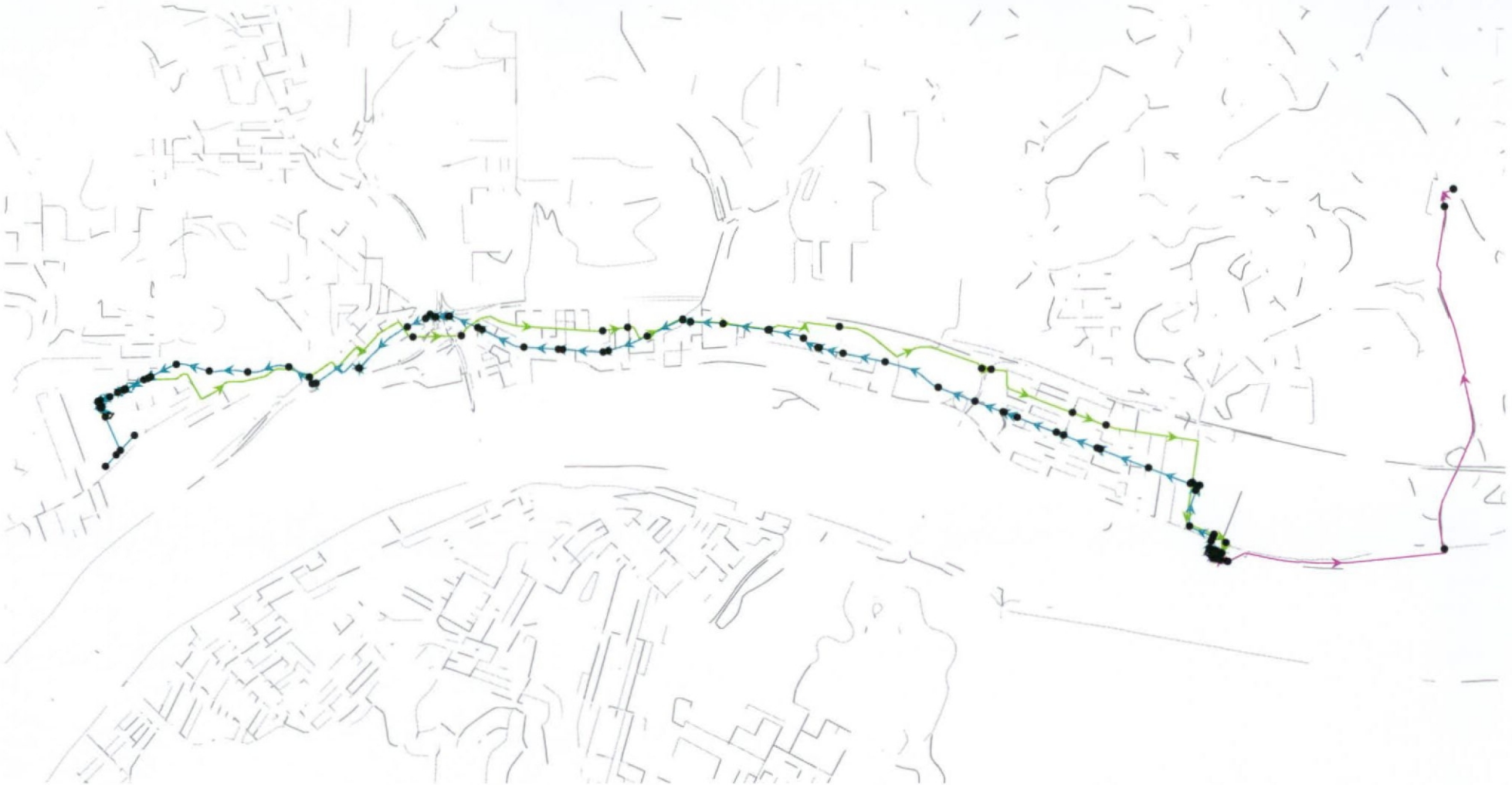


Figure 3 - Existing And New (36") Rising Mains



Exh. RAW/C-16

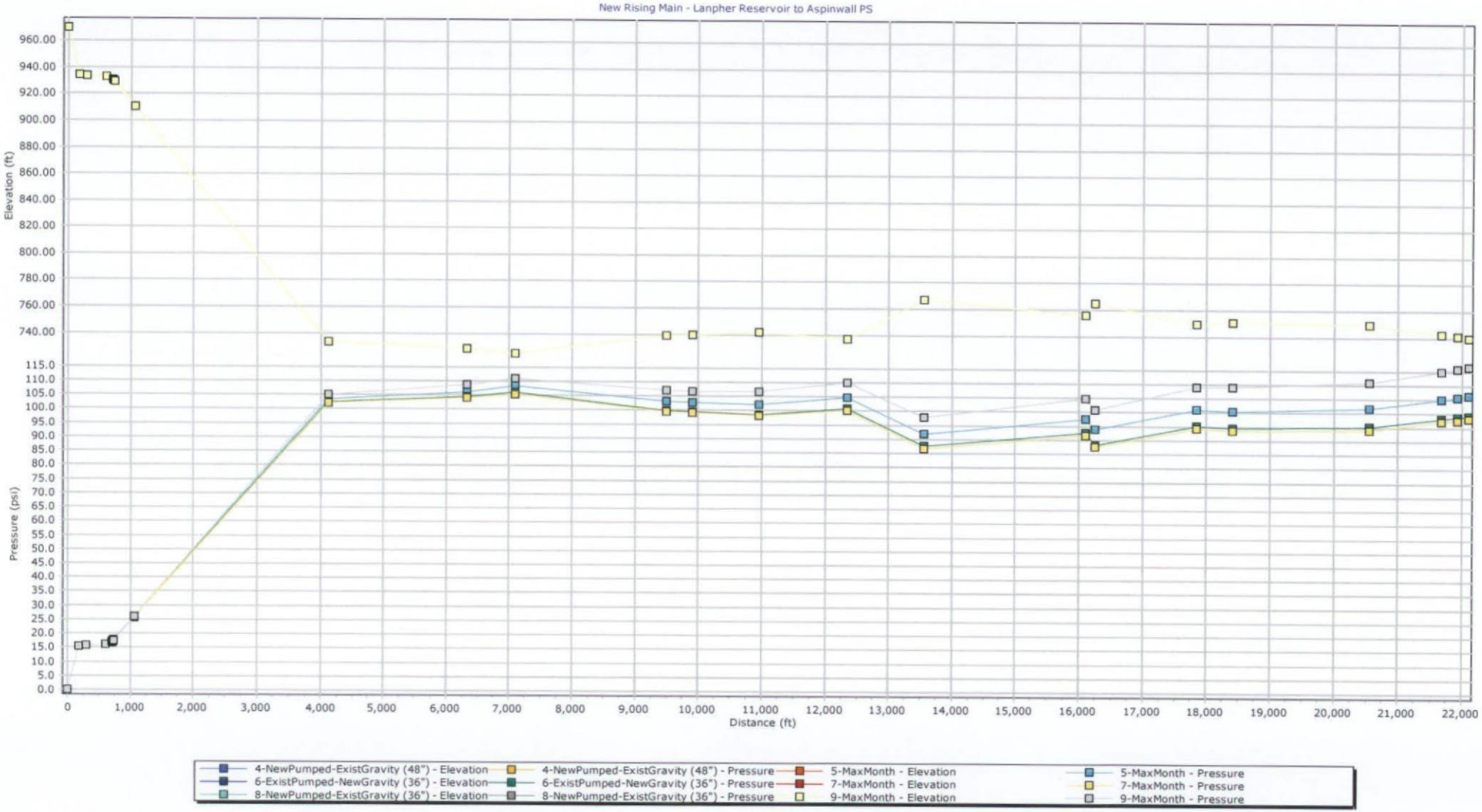
PWSA ASPINWALL TO LANPHER RISING MAIN
SUMMARY OF STEADY-STATE HYDRAULIC ANALYSES

		Aspinwall PS Pump Flow (MGD)								J-Demand-Aspinwall1		J-Demand-Aspinwall2		J-90 (FoxChapel PS Suction)		J-Demand-PA-8/ 28		J-Demand-Shaler		J-Demand-Sharpsburg		J-Demand-St.Marg's		J-Demand-W'worksMall	
Scenario	Scenario Description	Pump1	Pump2	Pump3	Pump4	Demand Total (MGD)	Inflow to Lanpher Reservoir (MGD)	Outflow from Lanpher Reservoir (MGD)	Lanpher Reservoir HGLE	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)	Flow (GPD)	Pressure (psi)
1	Existing 60" rising main - Aspinwall PS to Lanpher Reservoir	12.86	15.40	OFF	OFF	2.36	25.90	0.00	970	92,500	100	92,500	100	1,888,700	102	92,500	104	17,400	15.8	22,100	102	98,800	96.4	55,600	101
2	Exist. 60" RM to Lanpher Reservoir (no demands); new 48" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	12.78	15.33	OFF	OFF	2.36	28.11	2.36	970	92,500	95.3	92,500	94.7	1,888,700	99.4	92,500	104	17,400	15.8	22,100	101	98,800	93.8	55,600	98.3
3	Exist. 60" RM to Lanpher Reservoir (no demands); new 48" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	12.78	15.33	OFF	OFF	5.9	28.11	5.9	970	231,250	95.1	231,250	94.4	4,721,750	98.8	231,250	104	43,500	15.8	55,250	101	247,000	93.5	139,000	98.0
4	New 48" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	11.85	14.59	OFF	OFF	2.36	26.43	2.36	970	92,500	98.5	92,500	98.4	1,888,700	99.5	92,500	104	17,400	15.6	22,100	101	98,800	94.4	55,600	99.1
5	New 48" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	11.85	14.59	OFF	OFF	5.9	26.43	5.9	970	231,250	98.5	231,250	98.3	4,721,750	99.3	231,250	104	43,500	15.6	55,250	101	247,000	94.3	139,000	99.0
6	Exist. 60" RM to Lanpher Reservoir (no demands); new 36" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	12.78	15.33	OFF	OFF	2.36	28.11	2.36	970	92,500	95.2	92,500	94.6	1,888,700	99.2	92,500	104	17,400	15.8	22,100	101	98,800	93.7	55,600	98.1
7	Exist. 60" RM to Lanpher Reservoir (no demands); new 36" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	12.78	15.33	OFF	OFF	5.9	28.11	5.9	970	231,250	94.3	231,250	93.6	4,721,750	97.8	231,250	104	43,500	15.8	55,250	100	247,000	92.6	139,000	97.0
8	New 36" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with ADF demands)	9.32	12.63	OFF	OFF	2.36	21.95	2.36	970	92,500	98.5	92,500	98.4	1,888,700	99.5	92,500	104	17,400	15.6	22,100	101	98,800	94.4	55,600	99.1
9	New 36" RM from Aspinwall PS to Lanpher Reservoir (no demands); exist. 60" RM from Lanpher Reservoir to Aspinwall PS (with Max Mo. demands)	9.32	12.63	OFF	OFF	5.9	21.95	5.9	970	231,250	98.5	231,250	98.3	4,721,750	99.3	231,250	104	43,500	15.6	55,250	101	247,000	94.3	139,000	99.0

Exh. RAW/C-16


New Rising Main - Lanpher Reservoir to Aspinwall PS
Elevation (ft)
1,010.00
1,000.00
990.00
980.00
970.00
960.00
950.00
940.00
930.00
920.00
910.00
900.00
890.00
880.00
870.00
860.00
850.00
840.00
830.00
820.00
810.00
800.00
790.00
780.00
770.00
760.00
750.00
740.00
730.00
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
18,000
19,000
20,000
21,000
22,000
Distance (ft)
4-NewPumped-ExistGravity (48") - Elevation
6-ExistPumped-NewGravity (36") - Elevation
8-NewPumped-ExistGravity (36") - Elevation
4-NewPumped-ExistGravity (48") - Hydraulic Grade
6-ExistPumped-NewGravity (36") - Hydraulic Grade
8-NewPumped-ExistGravity (36") - Hydraulic Grade
5-MaxMonth - Elevation
7-MaxMonth - Elevation
9-MaxMonth - Elevation
5-MaxMonth - Hydraulic Grade
7-MaxMonth - Hydraulic Grade
9-MaxMonth - Hydraulic Grade

Exh. RAW/C-16


New Rising Main - Lanpher Reservoir to Aspinwall PS
Elevation (ft)
Pressure (psi)
Distance (ft)
4-NewPumped-ExistGravity (48") - Elevation
4-NewPumped-ExistGravity (48") - Pressure
5-MaxMonth - Elevation
5-MaxMonth - Pressure
6-ExistPumped-NewGravity (36") - Elevation
6-ExistPumped-NewGravity (36") - Pressure
7-MaxMonth - Elevation
7-MaxMonth - Pressure
8-NewPumped-ExistGravity (36") - Elevation
8-NewPumped-ExistGravity (36") - Pressure
9-MaxMonth - Elevation
9-MaxMonth - Pressure

E. Estimated construction costs

Pittsburgh Water and Sewer Authority - Lanpher Rising Main Feasibility Analysis Route No. 2

Item	*Unit (feet)*	*Item*	*Unit (feet)*
Pipe cover	5	Total Length (Rising Main)	19651
Pipe size (Rising Main)	4	Open Cut Length (Rising Main)	18156
Trench width (Rising Main)	8	Trenchless 1	180
Pipe size (Service Connections)	1	Trenchless 2	500
Trench Width (Service Conenctions)	4	Trenchless 3	815
Bedding depth	0.5	Total Length (Service)	3886
Road width - Average	12		

Item	Unit	Quantity	Unit Price	Extension
Open Cut	LF	18156		
48" Ductile Iron Pipe (push-on)	LF	14525	$272	$3,950,746
48" Ductile Iron Pipe (restrained)	LF	3631	$370	$1,343,544
12" Ductile Iron Pipe	LF	3886	$110	$427,460
Trenchless Crosings				
Crossing No. 1	LF	180	$1,350	$243,000
Crossing No. 2	LF	500	$1,600	$800,000
Crossing No. 3	LF	815	$2,200	$1,793,000
Excavation, Bedding/Backfill				
Excavation	CY	57250	$7	$400,748
Bedding	CY	48804	$20	$976,077
Labor				
Open cut pipe	Days	177	$8,840	$1,564,680
Trenchless 1	LS	1	$97,200	$97,200
Trenchless 2	LS	1	$320,000	$320,000
Trenchless 3	LS	1	$717,200	$717,200
Appurtenances				
48" Valves	Unit	8	$30,000	$240,000
Air Valve Chambers	Unit	8	$5,000	$40,000
Blowoffs	Unit	8	$2,000	$16,000
Utility Relocations				
Major	Each	5	$60,000	$300,000
Minor	Each	10	$6,000	$60,000
Service Connections				
Connections	Each	8	$35,000	$280,000
Road Restoration				
Pavement	SY	25935	$165	$4,279,293
Restoration				
Miscellaneous	LS	1	$125,000	$125,000
Other				
Traffic Control Signage	LS	1	$550,000	$550,000
Testing and Disinfection	LF	19651	$5	$98,255
Subtotal				**$18,622,203**
Overhead	10%			$1,862,220
Profit	10%			$2,048,442
Contingencies	30%			$6,759,860
Subtotal				$29,292,726
Escalation	6.00%			$31,050,289
Revised total for Route 2, rounded				**$31,050,000**

Pittsburgh Water and Sewer Authority - Lanpher Rising Main Feasibility Analysis Route No. 3

Item	*Unit (feet)*	*Item*	*Unit (feet)*
Pipe cover	5	Total Length (Rising Main)	21072
Pipe size (Rising Main)	4	Open Cut Length (Rising Main)	20327
Trench width (Rising Main)	8	Trenchless 1	180
Pipe size (Service Connections)	1	Trenchless 2	200
Trench Width and Pavement Width (Service Conenctions)	4	Trenchless 3	365
Bedding depth	0.5	Total Length (Service)	1281
Road width	12		

Item	Unit	Quantity	Unit Price	Extension
Open Cut				
48" Ductile Iron Pipe (push-on)	LF	16262	$272	$4,423,155
48" Ductile Iron Pipe (restrained)	LF	4065	$370	$1,504,198
12" Ductile Iron Pipe	LF	1281	$110	$140,910
Trenchless Crossings				
Crossing No. 1	LF	180	$1,350	$243,000
Crossing No. 2	LF	200	$1,600	$320,000
Crossing No. 3	LF	365	$2,200	$803,000
Excavation, Bedding/Backfill				
Excavation	CY	61367	$7	$429,568
Bedding	CY	51911	$20	$1,038,219
Labor				
Open cut pipe	Days	173	$8,840	$1,529,320
Trenchless 1	LS	1	$97,200	$97,200
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Utility Relocations				
Major	Each	5	$60,000	$300,000
Minor	Each	10	$6,000	$60,000
Service Connections				
Connections	Each	8	$35,000	$280,000
Road Restoration				
Pavement	SY	27672	$125	$3,459,000
Restoration				
Miscellaneous	LS	1	$125,000	$125,000
Other				
Traffic Control Signage	LS	1	$350,000	$350,000
Testing and Disinfection	LF	21072	$5	$105,360
Subtotal				**$15,990,130**
Overhead	10%			$1,599,013
Profit	10%			$1,758,914
Contingencies	30%			$5,804,417
Subtotal				$25,152,475
Escalation	6.00%			$26,661,623
Revised total for Route 3, rounded				**$26,662,000**

PGH2O Pittsburgh Water & Sewer Authority

August 21, 2018

Addendum No. 1

for

Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main

PWSA PROJECT NO. 2018-323-100-0

The following changes/additions/clarifications are applicable to the above-referenced solicitation:

CHANGE: Change the Project Name and Project No. to Aspinwall Pump Station to Lanpher Reservoir Rising Main 2018-323-100-0

CHANGE: The Proposal Due Date has been extended to Tuesday, September 18, 2018 at 4:00 p.m. EST

ADDITION: Equal Opportunity Plan (EOP)

ADDITION: EOP - Exhibit I

ADDITION: EOP - Exhibit II

ADDITION: Mandatory Pre-Bid Meeting Sign-In Sheet

ADDITION: Addenda Acknowledgement Form

ADDITION: Signature Page

ADDITION: Reference Form

Q&A:

Q1: Who is the contact person at PWSA to gain access to the plant or reservoir?

A1: Contact the Procurement Manager, Nicole Dickun (ndickun@pgh2o.com)

Q2: Are there any additional as-builts to the existing line?

Penn Liberty Plaza I
1200 Penn Avenue
Pittsburgh PA 15222

info@pgh2o.com
T 412.255.2423
F 412.255.2475

www.pgh2o.com
@pgh2o

Customer Service / Emergencies:
412.255.2423

PGH2O Pittsburgh Water & Sewer Authority

A2: Pertinent record drawings will be available to the awarded Consultant

Q3: Has PWSA specified the different types of pipe to be utilized on the project?

A3: It is the responsibility of the design engineer to determine the type of pipe

Q4: Will the material be purchased by the contractor?

A4: Undecided

Q5: Will PVC pipe be considered?

A5: It is the responsibility of the design engineer to determine the type of pipe

Q6: Are there any additional standard specifications that are available?

A6: Pertinent standard specifications will be available to the awarded Consultant

Q7: Are 500' borings typical or should more or less distance be required?

A7: This is to the discretion of the design engineer and should be addressed in your proposal

Q8: Is PWSA prepared to address schedule changes

A8: PWSA is aware that a change in scope will impact the schedule and it is the responsibility of both parties to respond to issues in a timely manner

Q9: Is the location of a firm in Allegheny County scored the same as if it were in the City of Pittsburgh?

A9: No. Firms with an office located in Pittsburgh are given preference.

Q10: Is PWSA able to provide a MWDBE supplier list?

A10: For questions concerning the EOP, please contact Julie Asciolla, Business Development Relations Manager (jasciolla@pgh2o.com)

ALL OTHER TERMS & CONDITIONS OF THIS SOLICITATION SHALL REMAIN THE SAME.

PGH2O Pittsburgh Water & Sewer Authority

August 31, 2018

Addendum No. 2

for

Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main

PWSA PROJECT NO. 2018-323-100-0

The following changes/additions/clarifications/replacements are applicable to the above-referenced solicitation:

CLARIFICATION: Presentation of Price and Cost Structure:

1. A proposed budget shall be supported with a breakdown of total fee submitted in matrix format that correlates with the tasks defined in Clause No. 3, Scope of Work, of the RFP.
2. A matrix shall provide defined staff level of effort (manhours) by task.
3. Development of total proposed fee shall be defined and presented as follows:
   a. Direct salary rate for each staff member;
   b. Total labor cost (direct salary rate x manhours) for each staff member;
   c. Overhead (including profit) rate (multiplier) for each staff member;
   d. Total labor billing dollars (total labor cost x multiplier) for each staff member;
   e. Total expenses for each task;
   f. Subconsultant fee and expenses for each task;
   g. Subconsultant markup (percentage);
   h. Subconsultant (including markup) dollars; and
   i. Total fee dollars by task and sum total.

ADDITION: Boring Log: The attached boring log is for location B2 identified in the Feasibility Report appended to the RFP. Please note that the log is labeled "B-1" however in the Feasibility Report it was redefined as B2.

ALL OTHER TERMS & CONDITIONS OF THIS SOLICITATION SHALL REMAIN THE SAME.

Penn Liberty Plaza I
1200 Penn Avenue
Pittsburgh PA 15222

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Customer Service /
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Pittsburgh Water and Sewer Authority - Lanpher Rising Main Feasibility Analysis Route No. 2

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Restoration				
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Pittsburgh Water and Sewer Authority - Lanpher Rising Main Feasibility Analysis Route No. 3

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PGH2O Pittsburgh Water & Sewer Authority

August 21, 2018

Addendum No. 1

for

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PGH2O Pittsburgh Water & Sewer Authority

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A3: It is the responsibility of the design engineer to determine the type of pipe

Q4: Will the material be purchased by the contractor?

A4: Undecided

Q5: Will PVC pipe be considered?

A5: It is the responsibility of the design engineer to determine the type of pipe

Q6: Are there any additional standard specifications that are available?

A6: Pertinent standard specifications will be available to the awarded Consultant

Q7: Are 500' borings typical or should more or less distance be required?

A7: This is to the discretion of the design engineer and should be addressed in your proposal

Q8: Is PWSA prepared to address schedule changes

A8: PWSA is aware that a change in scope will impact the schedule and it is the responsibility of both parties to respond to issues in a timely manner

Q9: Is the location of a firm in Allegheny County scored the same as if it were in the City of Pittsburgh?

A9: No. Firms with an office located in Pittsburgh are given preference.

Q10: Is PWSA able to provide a MWDBE supplier list?

A10: For questions concerning the EOP, please contact Julie Asciolla, Business Development Relations Manager (jasciolla@pgh2o.com)

ALL OTHER TERMS & CONDITIONS OF THIS SOLICITATION SHALL REMAIN THE SAME.

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PGH2O Pittsburgh Water & Sewer Authority

August 31, 2018

Addendum No. 2

for

Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main

PWSA PROJECT NO. 2018-323-100-0

The following changes/additions/clarifications/replacements are applicable to the above-referenced solicitation:

CLARIFICATION: Presentation of Price and Cost Structure:

1. A proposed budget shall be supported with a breakdown of total fee submitted in matrix format that correlates with the tasks defined in Clause No. 3, Scope of Work, of the RFP.
2. A matrix shall provide defined staff level of effort (manhours) by task.
3. Development of total proposed fee shall be defined and presented as follows:
   a. Direct salary rate for each staff member;
   b. Total labor cost (direct salary rate x manhours) for each staff member;
   c. Overhead (including profit) rate (multiplier) for each staff member;
   d. Total labor billing dollars (total labor cost x multiplier) for each staff member;
   e. Total expenses for each task;
   f. Subconsultant fee and expenses for each task;
   g. Subconsultant markup (percentage);
   h. Subconsultant (including markup) dollars; and
   i. Total fee dollars by task and sum total.

ADDITION: Boring Log: The attached boring log is for location B2 identified in the Feasibility Report appended to the RFP. Please note that the log is labeled "B-1" however in the Feasibility Report it was redefined as B2.

ALL OTHER TERMS & CONDITIONS OF THIS SOLICITATION SHALL REMAIN THE SAME.

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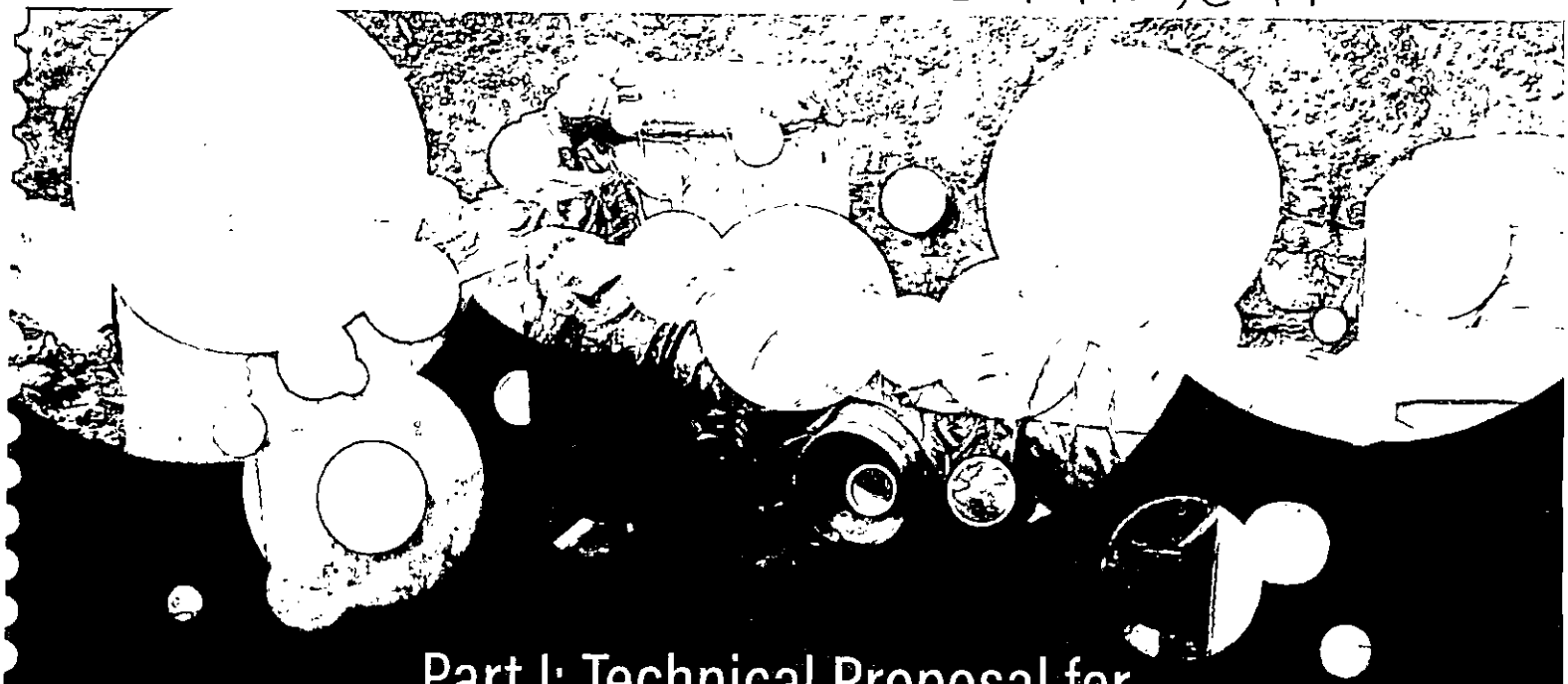
Exh. RAW/C-17



Part I: Technical Proposal for **Aspinwall Pump Station to Lanpher Reservoir Rising Main**

PWSA Project No. 2018-323-100-0

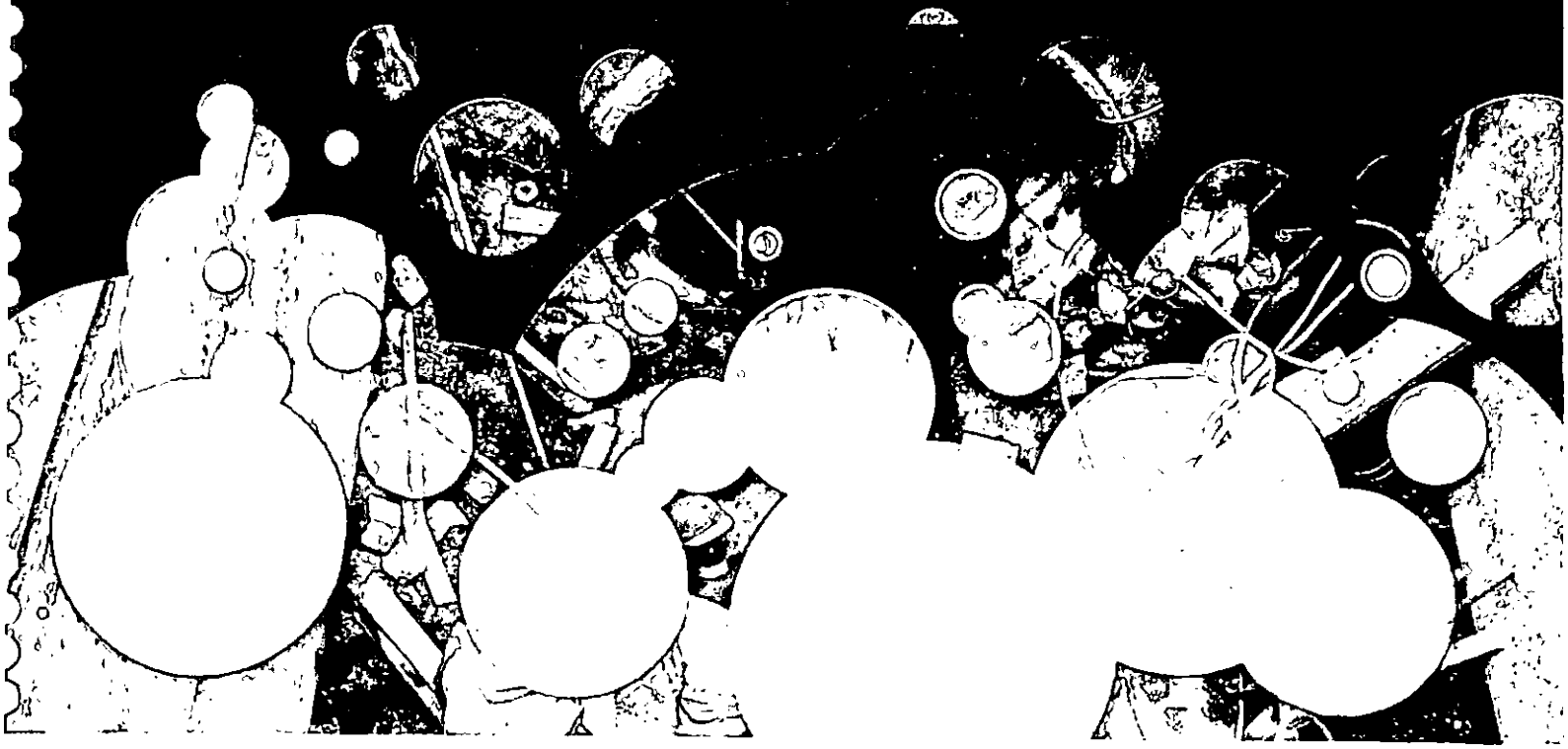
September 18, 2018

Submitted to:
Pittsburgh Water and Sewer Authority

PGH2O

Submitted by:
Michael Baker International, Inc.

Michael Baker
INTERNATIONAL



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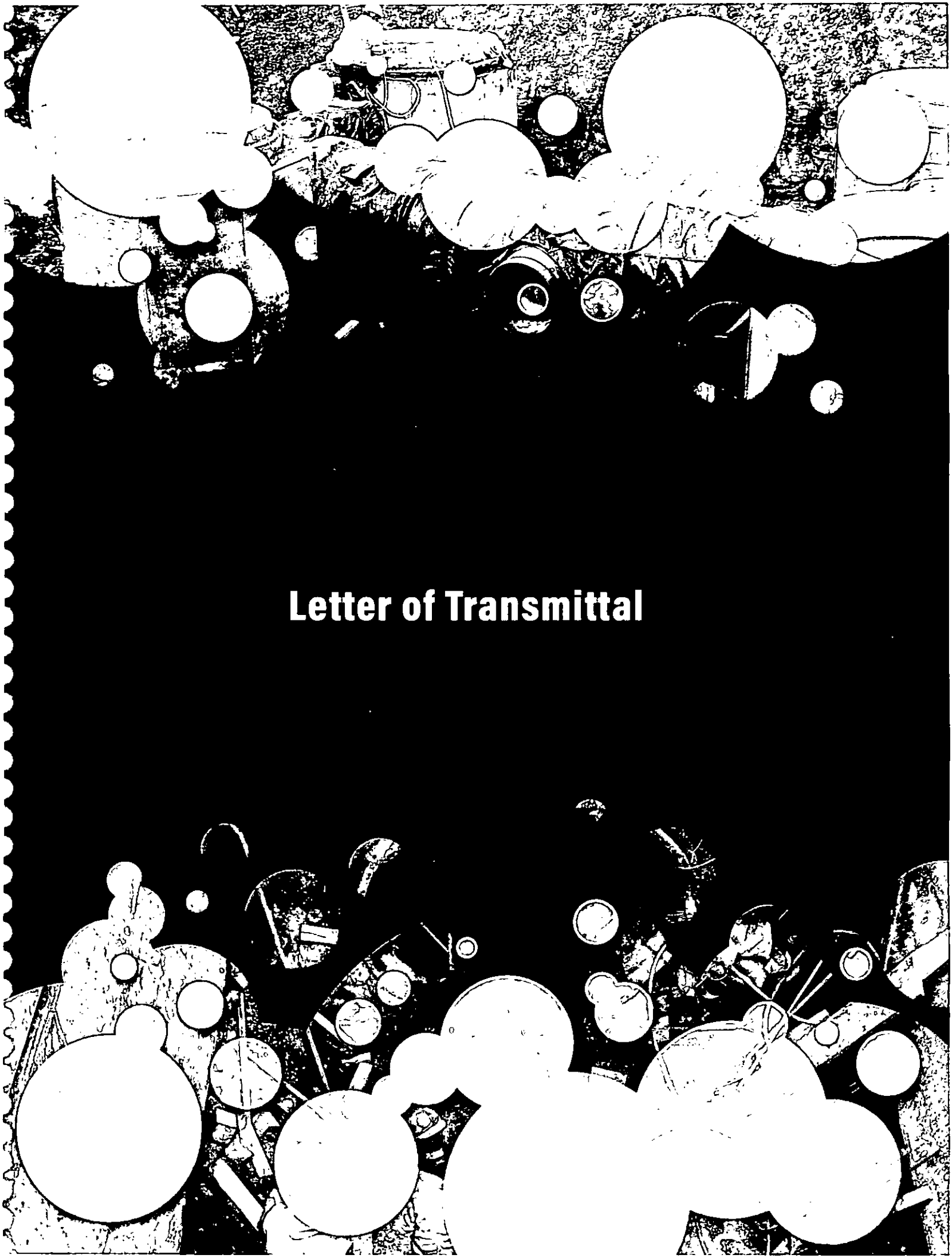


Letter of Transmittal

SECTION 1: LETTER OF TRANSMITTAL

September 18, 2018

Ms. Nicole Dickun, Procurement Manager
Pittsburgh Water and Sewer Authority
1200 Penn Avenue, 2nd Floor, Pittsburgh, PA 15222

Dear Ms. Dickun,

Michael Baker International, Inc. (Michael Baker) has a long history with the PWSA dating back over 30 years and has helped solve some of your most complex engineering challenges. We have completed projects at several of your reservoirs, your water treatment plant, and within your water and sewer systems. We are familiar with your standards, rules and regulations, permitting requirements, and compliance issues related to the operation and maintenance of your systems, which makes Michael Baker an excellent choice for your upcoming Aspinwall Pump Station to Lanpher Reservoir Rising Main project.

We pride ourselves on being responsive to the PWSA. Michael Baker has office locations in both downtown Pittsburgh and Moon Township and can respond quickly and cost-effectively to your needs. Our team brings a wealth of knowledge and experience to serve the PWSA's needs, including:

- **A proven track record of success with the PWSA and local clients.** This project team has been responsible for the coordination, management, and design of numerous municipal multi-task contracts across the Pittsburgh region. Additionally, we have managed large programs in urbanized areas under extreme time and financial constraints -- and have completed these programs on time and within budget.
- **Unparalleled project team experience with utility relocation design in the proposed project area.** The project team has previous experience working on the PWSA's 60-inch waterline in the Millvale area, as well as a unique trenchless crossing of the existing 60-inch waterline and relocation of over one mile of 24-inch transmission main in a tight urban corridor. Design and construction engineering was provided as incorporated work as part of the PennDOT SR28 East Ohio Street Reconstruction Project.
- **Familiarity with local agency requirements.** Our project team personnel are intimately involved daily with the review and approval processes associated with PaDEP, the local municipalities, including the city of Pittsburgh, PennDOT, Norfolk Southern, etc. We know the written regulations and the unpublished policies and how they can impact the design and construction process if not proactively managed.
- **Technical expertise to address the design complexities of the project.** The project team has specialized experience in all technical facets of the Aspinwall Pump Station to Lanpher Reservoir Rising Main project including survey, water main design, cost control, environmental, traffic control, permitting, geotechnical, corrosion control, and construction support services.
- **An experienced, professional management team.** Our project team includes dedicated personnel with the qualifications and experience to manage a multi-task contract of this scope and complexity required for this effort. Our Team will be led by Mr. Brad Duda, P.E. and we have committed to Mr. Duda's availability as Project Manager for this important project. Because of Brad's technical experience and utility infrastructure expertise, combined with his PWSA process knowledge and his project vicinity and adjacent projects history, he is uniquely qualified to lead our strong technical team of Michael Baker personnel and qualified subconsultants. We have listened to recent feedback from the PWSA about our project organization and specifically utilizing our national expertise to enhance our local project team. To accomplish this, Brad will be supported on this project by our Regional Water Practice Director, Mr. Fred Muncy. Mr. Muncy brings years of large diameter waterline experience to the project, many of which have been designed and constructed in tight urban areas such as the Lanpher setting. Mr. Muncy will be an integral part of our project team, giving us the largest and strongest local team, with exceptional national technical support.
- **A Diverse and experienced team of experts.** Our team of subconsultants represents our shared commitment to diversity and meaningful engagement of the Minority Business Enterprise (MBE) community as well as selection of key non-MBE firms that offer PWSA the highest level of expertise. As a mentor firm sponsor of the Southwestern Pennsylvania Engineering Outreach (SPEO), we take our responsibility and commitment seriously and hold standing relationships with many local MBE/WBE and SDVOB companies and have leveraged those relationships. For this proposal our team will include the following members:

FIRM NAME
Michael Baker International, Inc.

OFFICES
500 Grant Street, Suite 5400
Pittsburgh, PA 15219

100 Airside Drive
Moon Township, PA 15108

YEAR ESTABLISHED
1940

DUNS NUMBER
956772347

OWNERSHIP TYPE
Limited Liability Company

POINT OF CONTACT
Brad Duda, PE | 412.269.6060
bduda@mbakerintl.com

- Johnson, Mirmiran & Thompson | SUE, Modeling and QA/QC | JMT has extensive experience in SUE not only in the region but in the specific work area. Their experience with large diameter water transmission lines allows them to offer a wealth of experience in the role of modeling and QA/QC.
- McMillen Jacobs Technologies, Inc. | Trenchless Crossings | McMillian Jacobs are trenchless experts and will bring that expertise to the team, allowing us to provide the best solution for tunneling where needed.
- Executive Solutions Associates | Cost Estimating (SDVOB) | ESA will apply their knowledge of the local market to provide accurate and comprehensive cost estimating and represents the SDVOB member of our team.
- Ackenheil Engineers, Inc. | Geotechnical Testing (WBE) | Achenial will perform all Geotechnical laboratory testing. Their knowledge of local soil properties will help our team to understand these constraints.
- AWK Consulting Engineers, Inc. | Geotechnical Investigation (MBE) | AWK will perform all Geotechnical drilling and coring work for the project. Their team has extensive experience around the project and knows the process for quickly and efficiently executing the drilling program.
- Karen Brean Associates | Community Outreach (WBE) | KBA will assist in the Workshop and outreach efforts for the project. Her local knowledge is a great resource for connecting with community groups and stakeholders.
- Monaloh Basin Engineers | Survey and Mapping Support | (MBE) Monaloh will perform the survey of the underground features and surface topography for the selected route. They provided all survey for the adjacent Route 28 project and are familiar with the project area.
- Sci-Tek Consultants, Inc. | Phase I Environmental Assessment (MBE) | Sci-Tek will provide the full Phase 1 ESA and offer the PWSA a wealth of experience and expertise to ensure that the environmental conditions are accurately documented for the entire route.
- Cosmos Technologies, Inc. | Field Investigation (MBE) | Cosmos will assist in the field services both during the design phase and throughout construction.
- Robinson Pipe Cleaning Co. | CCTV (WBE) | RPC will assist in the CCTV of utilities during the design phase of the project.

- **Capacity and flexibility to perform the work.** Current and projected workloads of the project team will allow the assignment of necessary resources to expeditiously and effectively accomplish all task orders within your required time frames. This work will be performed in Michael Baker's fully staffed Pittsburgh Based offices. This proximity allows us to respond quickly and be at the PWSA's office and on the project site as required to meet with design staff or respond to construction phase needs. We also have the flexibility and capacity to use additional engineers and technicians in our Virginia Beach office, if necessary, many of whom have been involved with local and regional large-scale transmission and water main designs in urban environments.
- **Commitment to high-quality service and owner satisfaction.** The project team approach includes an integral quality review throughout the design process; continual dialogue will be maintained between the PWSA, key project team members, and approving agencies to assure satisfaction of the technical and regulatory requirements.

Should you have any questions, please do not hesitate to contact Brad at 412.269.6060 or bduda@mbakerintl.com.

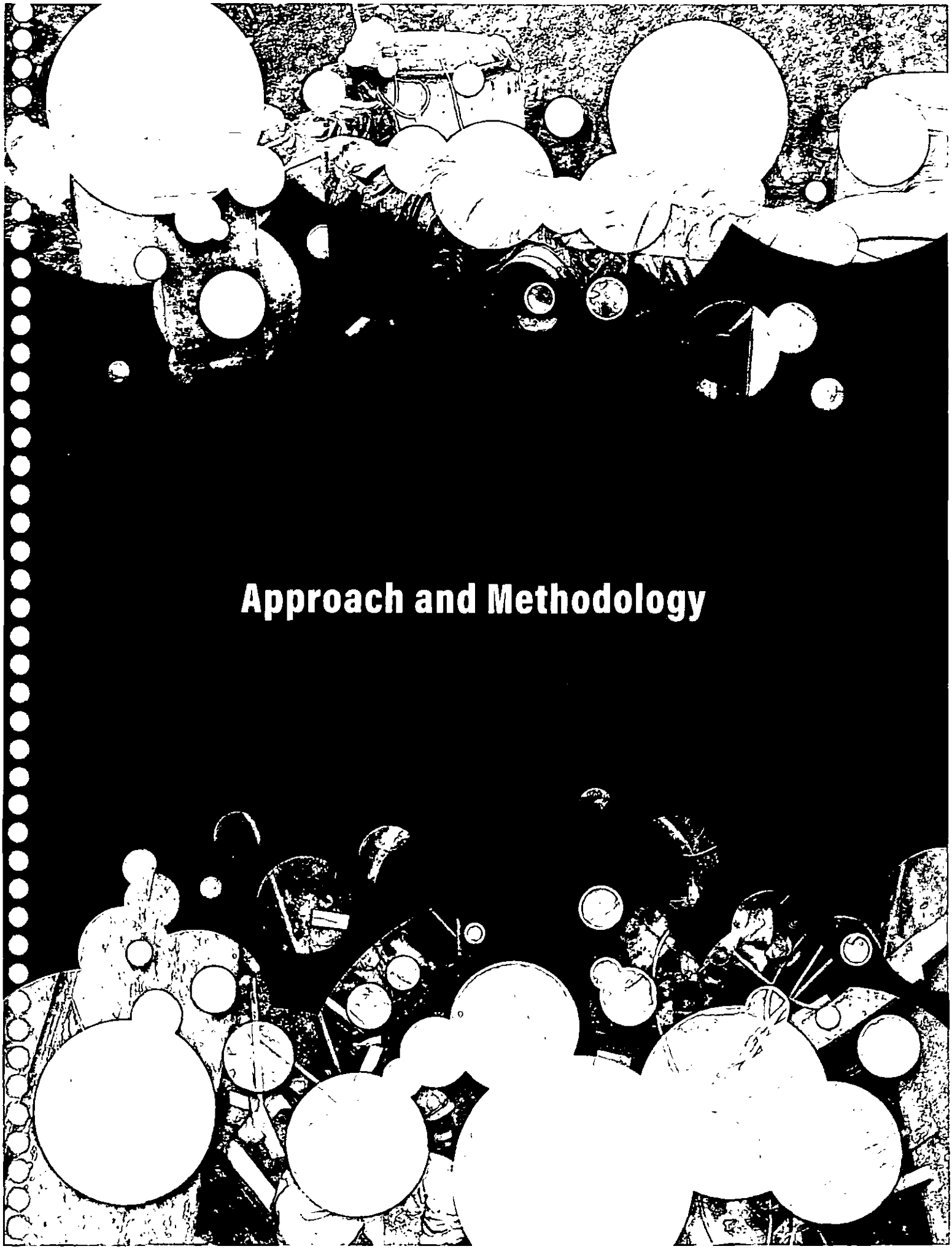
Sincerely,
MICHAEL BAKER INTERNATIONAL, INC.

Fred Muncy, PE
Senior Vice President, Regional Water Practice Director

Brad Duda, PE
Project Manager

WHY MICHAEL BAKER

THE PWSA HAS TRUSTED MICHAEL BAKER WITH MAJOR CAPITAL PROJECTS SINCE 1983
DETAILED CRITICAL PATH METHOD-BASED SCHEDULE
UNPARALLELED TEAM EXPERIENCE WITH UTILITY RELOCATION DESIGN IN THE PROPOSED PROJECT AREA
PITTSBURGH-BASED TEAM WITH UNMATCHED LOCAL KNOWLEDGE & BENCH STRENGTH
RELATIONSHIP WITH THE LOCAL MUNICIPALITIES AND STAKEHOLDERS



Approach and Methodology

SECTION 2: APPROACH & METHODOLOGY

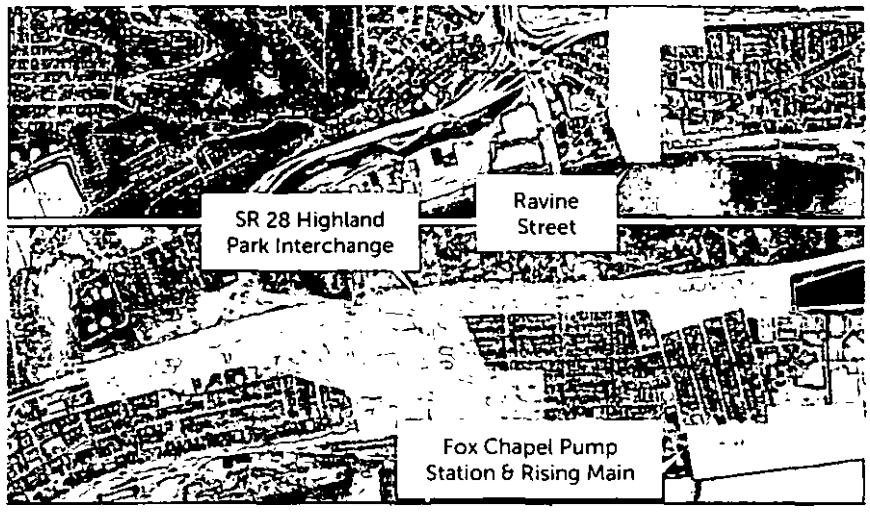
On August 8, 2018, the Pittsburgh Water and Sewer Authority (PWSA) issued a Request for Proposals (RFP) for the Aspinwall Pump Station to Lanpher Reservoir Rising Main Project, PWSA Project No. 2018-323-100-0. The intent of the contract is to design the horizontal and vertical alignment for a redundant waterline beginning at the Aspinwall Pump Station at the PWSA's water treatment facility (WTP) and ending at the Lanpher Reservoir in Shaler Township. The existing Lanpher Rising Main is a 60-inch riveted steel pipeline that is nearly 100 years old and, over the past year, was damaged, requiring expensive repairs. Designing and constructing a redundant rising main will improve water quality and reduce the need for emergency repairs to the existing rising main. **Michael Baker understands that time is a critical element to this project**, not only due to the state of the existing Lanpher Rising Main, but also to move forward with planned capital improvements that will require extensive coordination and understanding of the project constraints including existing infrastructure/utilities, adjacent structures/property, subsurface conditions, community impacts and local traffic conditions, permitting requirements and local terrain.

DIFFERENTIATOR

FAMILIARITY WITH THE PROJECT AREAS

The Michael Baker team has a unique understanding of the project areas in which the new rising main is proposed to be constructed. Active projects include the State Route 28 Highland Park Interchange and the Ravine Street Stream Removal, both of which have areas that encompass significant portions of the rising main pipeline routes as depicted in the RFP. Within those project areas, Michael Baker has already conducted extensive mapping, surveying, and utility investigations. Current project areas have included subsurface utility engineering (SUE) work that includes Level A (test pit) and Level B (electronic locating) of underground utility lines. The existing 60" waterline actually crosses beneath the Highland Park Bridge interchange, and coordination with the PWSA was a component of our investigations in that area. During utility investigations, Michael Baker not only gained detailed knowledge of the systems but also established relationships with the utility owners and representatives with facilities in the various project areas. Because of our knowledge of the area, the team would begin this project with a huge time-saving advantage.

Another benefit of Michael Baker's current work in these areas has been our coordination efforts with Norfolk Southern Railroad, who maintains mainline tracks along the corridor. Additionally, Michael Baker has been a consultant to Norfolk Southern Railroad and CSX Railroad on their Pittsburgh Vertical Clearance projects. The team will be able to ensure that design aspects that involve the two respective railroads will be handled with the utmost efficiency.



Directly within the project area, Michael Baker has current or previous project experience, knowledge of the municipalities, and detailed mapping of existing utilities and subsurface information.

Near the Aspinwall Pump Station, Michael Baker has extensive knowledge of the utility systems because of our previous work on the PWSA Fox Chapel Pump Station and Rising Main Project. The study and design phases of that project encompassed extensive utility reconnaissance activities as part of the route analyses for the 16-inch transmission main that was eventually constructed to provide potable water to the Fox Chapel Authority. The complexities of crossing under the Norfolk Southern Railroad tracks and the various major utility lines that occupy the Freeport Road corridor were analyzed as the pipeline routes were reviewed. Additionally, the vast network of facilities within the PWSA water treatment plant site also presents challenges with regards to routing of a large diameter waterline from the pump station building to the preferred transmission main route.

TASK 1: PRELIMINARY DESIGN REPORT

The first step in the development of any plan is to best understand the constraints and conditions under which the design and construction of the project must be executed. Thus, the Preliminary Design Phase begins with the review of available data, plans, and existing information (including utilities and geotechnical reports) to best understand the concept alignments that the PWSA has worked to develop. This would begin with the evaluation of the 2016 Lanpher Rising Main Feasibility Report prepared by Mott MacDonald. During our initial review of the copy provided with this RFP, **the Michael Baker team found the preferred alignment would need to be altered to avoid known historic and current landslides, congested utility corridors, and possible cultural resources (buried canal under Canal Street).** ***This type of readily available design input is proof of our unparalleled local knowledge differentiator.***

A. PROJECT BACKGROUND

Early contact and understanding of the required permitting is necessary to minimize delays to the construction schedule.

The Michael Baker team will include a justification for the selected alternative, based on existing project location conditions, potential constraints and conflicts with existing utilities, and constructability concerns. Although a preliminary plan does not require actual permit applications or authorizations, understanding the requirements of environmental permits is important for making recommendations of the proposed plan. **This is especially important because of the negative impact permitting can have on schedule when not properly coordinated.** Several federal, state, and local environmental and natural resources regulations apply to public and private activities in the Commonwealth of Pennsylvania. Environmental and natural resource regulations and permits, as well as municipal, and Norfolk Southern Transport permits, are listed in Task 2 Final Design and Permitting - Meetings.

The Michael Baker team will collect available data that exists regarding this waterline project. These data will be organized, reviewed, and incorporated into the preliminary design plans along with our recommendations based on the review of the 2016 Feasibility Study. Principally, data will be gathered through the following:

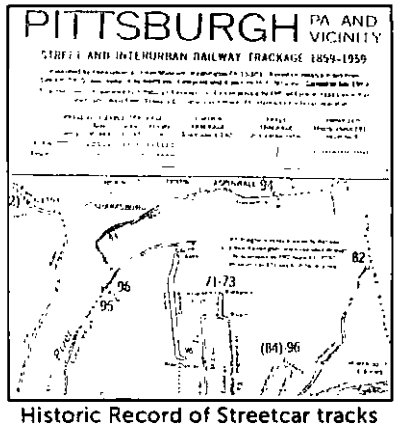
- The kick-off and subsequent meetings with the PWSA
- Existing aerial photography and mapping
- Existing ROW and tax map plans
- Existing geotechnical information in vicinity
- Existing archaeological information
- Existing hydraulic data
- Existing wetland maps
- Existing and future roadway plans and corridor limits
- Existing public and private utility and storm drainage plans
- The PWSA Water system maps, record drawings, design guidelines, standard details, technical specifications, and contract documents

B. FIELD VIEW AND SITE ASSESSMENTS FOR TRENCHING AND TRENCHLESS INSTALLATION

The study of existing conditions incorporates a combination of desktop assessment of existing data, previous planning documents and studies and utility record plans, as well as onsite observations made during site visits.

- **Existing Conditions:** The Michael Baker team will perform desktop and field investigations to evaluate existing infrastructure within the planned route to determine the level of constraint and conflicts present with existing utilities and other features of the built and natural environment. Photographs of these conditions will be provided.
- **Project Physical Conditions:** The Michael Baker team will perform desktop analysis of the Study Area Geology, Soils, Geomorphology, and Hydrology to determine any influence or impacts on the route when considering these items. Planning the construction of the proposed redundant waterline must carefully consider existing physical conditions to assess:

- Existing subsurface conditions especially related to soils. Due to the very tight urban nature of the project, with many old structures and infrastructure influencing all alignments, existing soils and how soils are supported and shored during construction will be critical to the success of the project. Old foundations, adjacent buildings, pavements, sidewalks, and existing utilities all will need to be considered based on existing soils and proposed excavation.
- Understanding areas exhibiting historic landslide and stability problems will be critical to establishing an appropriate alignment. Due to the size of the waterline and the potential required depth to avoid existing utilities, excavations through past landslide areas could reactivate stability problems and impact adjacent structures and infrastructure. Identification and avoidance of these areas will be essential during evaluation of alignments.
- Certain portions of alignments will need to be constructed utilizing trenchless techniques to establish the new waterline. This may be required to pass under roadways, railroads, existing structures, and other utilities. Understanding subsurface conditions to allow for appropriate consideration of trenchless applications will be critical.
- Understanding and identifying segments of the alignment that may be impacted by obstructions will be critical to controlling claims during construction related to changed conditions. Obstructions generally fall into three categories, including old or buried obstructions from past facilities, slag or industrial fill which often solidified into impregnable soils, and shallow bedrock conditions, which could exist when the alignment leaves the river valley and heads up slope to the reservoir.
- Due to the historic urban fills in the project area, it will be important to develop an understanding of past land uses to identify and avoid areas which may contain contaminated soils.
- A review of historic records conducted as part of projects in the nearby areas reveals the possible presence of existing streetcar tracks along the Freeport Road corridor. Investigation of such records is critical to ensure that accommodations are made during design to account for the possibility of encountering buried tracks during construction.



Historic Record of Streetcar tracks in project area along Freeport Road

Phase 1 Environmental Assessments | While a full Phase I Environmental Assessment (ESA) is to be completed during the final design of this project, **the Michael Baker team suggests that during the preliminary design, a Phase I ESA Screening be completed. This screening will be key in determining the final alignment.** The Michael Baker team will conduct a Phase I ESA Screening for the site in accordance with all state and federal regulations. This will include a site visit and applicable research required to complete the Phase I screening report. The Phase I ESA Screening of the proposed pipeline routes will be performed to aid in the alternatives analysis. The study area will include roughly 15 feet on either side of the proposed pipeline route(s). The Phase I ESA screening will research and summarize readily available current and historical information about the project corridor and adjacent properties to identify potential recognized environmental conditions. Specifically, the Phase I ESA will identify general site conditions, operations, and historical occurrences that may have resulted in the release of hazardous materials, petroleum products, or other environmentally sensitive materials. After the preliminary design has been completed and the alignment has been finalized, a Phase I ESA will be performed during the Final Design, in accordance with ASTM 1527-13. A full description is found under Task 2: Final Design. This Phase I ESA screening will consist of the following components:

- Task 1 - A review of readily available environmental records, published environmental databases relevant to the project site
- Task 2 - A site reconnaissance
- Task 3 - A written report of findings

Phase I ESA - Records Review

The Michael Baker team will use a commercial environmental database service (e.g., Environmental Data Resources, Inc.[EDR]) to provide a summary of available federal, state, and local environmental databases. Radial search distances will be in accordance with ASTM E-1527-13. Michael Baker will also obtain and review, historical aerial photographs, Sanborn® fire insurance maps, historic United States Geological Survey (USGS) topographic maps, and the Pennsylvania Department of Environmental Protection (PADEP) eMapPA website. The Michael Baker team will also review any previous studies performed by the PWSA (e.g., previously prepared environmental reports, geotechnical reports, permits, etc.).

Phase I ESA - Site Reconnaissance

The Michael Baker team will conduct a site reconnaissance of the proposed pipeline route alternative(s) and surrounding sites. The reconnaissance will include a noninvasive visual inspection of the pipeline route alternative(s) to evaluate present site conditions and search for evidence of past activities that may pose an environmental concern or other project constraint. Available mapping will be used in noting locations of features of potential environmental concern. Additionally, photographs of general site conditions, adjoining properties, and areas/features of potential concern (if any) will be obtained for inclusion in the Phase I ESA report. It is assumed that the route(s) can be viewed from within the public right-of-way and that no property-specific access agreements will be required.

Phase I ESA - Report

A Phase I ESA Report will be prepared for the pipeline route alternative(s) from the information gathered from the records review and site reconnaissance. The report will identify areas of potential concern that may impact construction costs and/or need further investigation. The Michael Baker team will provide an electronic copy of the report to the PWSA.

C. ALIGNMENT EVALUATION | ABILITY TO IMPLEMENT TRIPLE BOTTOM LINE APPROACH

With every project, it is Michael Baker's commitment to have the best interest of our community, planet, and economy

Michael Baker demonstrates our commitment to sustainability and the Triple Bottom Line (TBL) for this project, as well as our day-to-day operations, as summarized below. The foundation for the project is built upon the TBL philosophy that promotes the core principle of sustainability through the consideration of social, economic, and environmental impacts/factors this project will have on the community.

SOCIAL | Communities/Neighborhoods/People serve as the backbone in creating a vested interest for any project. The Michael Baker team understands the need to coordinate with the PWSA, property owners and other stakeholders.

ECONOMIC | The Michael Baker team understands what it takes to bring groups with varying interests together to achieve lasting value for this project.

ENVIRONMENT | Michael Baker is a recognized leader in the application of cost-effective, environmentally conscious solutions for its projects through engineering sustainable solutions that conserve our planet's resources throughout the full course of their life-cycle.



LEED | Leadership in Energy and Environmental Design

111 CERTIFIED EMPLOYEES

10 ENVISION SUSTAINABILITY PROFESSIONALS

88 PROJECTS DESIGNED FOR LEED CERTIFICATION

Michael Baker's approach to infrastructure projects has embraced the TBL philosophy for many years. While not historically using the moniker or trade reference of "TBL," our facilities and linear project Preliminary Alignment analyses and Alternative Evaluations scoring criteria have always included consideration and weighting of community, economic, and environmental impacts. We consider the lasting impact of our planning, design, engineering, building, and revitalization efforts. Many project recommendations, e.g., Holland Road Force Main and Hilltop/Point O' Woods Force Main, included project solutions where community/social impacts and/or environmental impacts largely outweighed cost impacts. In these situations, the lowest cost alternatives were not always recommended.

IMPACTS TO SERVICE AND BUSINESSES

Multiple land use types will be affected by the construction of the Redundant Lanpher Rising Main. The Michael Baker team will perform quality control to ensure the selected alignment routes minimize impacts for the following:

- Traffic, local and highway
- Temporary water service/outages, use of wet tapping procedures
- Preliminary construction sequencing

TRIPLE BOTTOM LINE PROJECT EXAMPLES

Holland Road Force Main Corridor Evaluation | Hampton Roads Sanitation District, Suffolk, Virginia

- **Project Description** | This complex two-phase project includes nearly 7 miles of linear pipelines (HRSD FM, City of Suffolk FM, and Water Mains), multiple PS interconnections, numerous public and private stakeholders, significant environmental crossings, and clearances along a corridor traversing from undeveloped land to suburban residential to historic Downtown Suffolk. The preliminary engineering phase of this project included evaluation of six primary alignment alternatives and over 20 individual corridor segments. A comprehensive evaluation matrix, including 13 social, environmental, economic, and O&M criteria and weighting, was developed to assess, rank, and score each alternative and segment. The social impacts of working in and along existing narrow arterial roadways proved to generate the least preferable options; therefore, an alignment largely along an abandoned Railroad R/W was chosen.
- **Outcomes and Relevance to the PWSA** | The preferred alternative selected for the FM project provided a balanced solution to the key stakeholders, including HRSD, City of Suffolk, businesses, and residents. Because of the "TBL" type analysis, the lowest social/community impacting alignment was chosen; this route was also the lowest economic impacting alternative. The alignment was not the lowest environmental impacting alternative; however, the key environmental issue, crossing Lake Meade, was accomplished using an HDD with little environmental disruption and favorable regulatory permitting.

Pump Station 27 Service Area | City of Norfolk, Norfolk, Virginia

- **Project Description** | This multi-phase, decade-long program for upgrading and replacing city-owned wastewater assets in a large suburban sewershed service area includes over 15 miles of sanitary gravity and force main system and replacement of a 3,400 gpm wet well/dry well wastewater pumping station. Critical to the success of the system replacements has been maintaining continuity of wastewater service; minimizing construction impacts to residents, businesses, and traveling public; and eliminating undersized, failing, inaccessible, or inadequate sloped gravity pipe sections. Evaluation of multiple options using a "TBL" type analysis concluded the service area needed to be subdivided into two smaller service areas and an additional pump station added. New sites were evaluated for the new and replacement stations and assessed based on cost, environmental impacts (wetland and park), costs (particularly trench and wet well depths), and social impacts (neighborhood setting issues and impacts on traffic). The replacement station site chosen was a distressed property that scored very well on all evaluation criteria, the new station site one on existing city property that minimized public disruption, and system depth/cost. The local water distribution system was also replaced to renew all city-owned utility assets in the service area simultaneously.
- **TBL Outcomes and Relevance to the PWSA** | The chosen alternatives provided solutions which allowed continuous operation of the existing wastewater system until phased completions were made operational. Public outreach and involvement gained buy-in from residents for pump station site selection and the approach to minimizing trench depth in already established neighborhoods and thoroughfares offered less community disruption, simpler traffic control, and less expensive construction. The multi-project phasing approach added cost to the overall program but minimized social impacts to the community by allowing access to residents and businesses in a predictable manner. The pump station replacement includes a self-cleaning bar screen, baffle walls in the wet well, and photoionization odor control technology.

Lucas Creek – Woodhaven Interceptor Force Main Replacement Phase I PER | HRSD – Newport News, Virginia

- **Project Description** | This project includes the replacement of approximately 5,200 linear feet of 24-inch ductile iron force main within the median of the congested corridor of Warwick Boulevard involving multiple pump station interconnections and various public and private stakeholders. The preliminary engineering report evaluated two primary alignment options, as well as numerous options for interconnecting the proposed force main to the existing force main by utilizing the flexibility in interceptor operations which allows flow reversal for short periods of time in this portion of the system. Extensive coordination was required with the city of Newport News and VDOT to accommodate previously scheduled paving work, as well as the VDOT Atkinson Boulevard project along Warwick Boulevard. Traffic disruption, concern of removal of trees, and costs of the various options proved to be the primary differences in the evaluation of alternatives.
- **TBL Outcomes and Relevance to the PWSA** | The project schedule was accelerated to complete work within the limits of the VDOT project and reduce potential costly schedule disruptions and traffic congestion from multiple contracts being underway. The overall pipe

alignment was positioned in the median of Warwick Boulevard as much as possible to maximize pipe laying production and minimize paving restoration in the newly paved roadway. A detailed landscaping plan was negotiated with the city to replace the trees to be taken from the median. This median alignment also improves safety of HRSD personnel during future maintenance of the new pipeline over an "in roadway" location. Costly and time-consuming trenchless crossings of Warwick Boulevard were also avoided through discussions with the city on the merits of open cut "speed" versus trenchless "longer term side road traffic control and open pit risks." The city agreed the crossings could be expedited by open cut during low traffic flow periods. The preferred alternative for interconnecting the proposed force main to the existing force main provided maximum flexibility to the contractor during pump station interconnections to ensure timely project completion.

D. PRELIMINARY DESIGN REPORT

As part of the Preliminary Design Evaluation, the Michael Baker team shall develop a Design Memorandum to provide professional engineering, geotechnical, and environmental guidance for the Lanpher Rising Main Project. This document will review the current approach, then identify, evaluate, and recommend a selected alternative. Michael Baker will execute a field view to assess and photograph the existing conditions and constraints. The Design Memorandum will include a summary of the field view and a photograph report of the existing conditions. In addition, the Design Memorandum will include a planning level site layout exhibit illustrating the location of the proposed design features, as well as typical details exhibits. **The Michael Baker team will also include the findings from the Triple Bottom Line into the findings of the Design Memorandum, discussing the economic, environmental, and social advantages and disadvantages the team found during the preliminary design assessment process.** This deliverable will contain a narrative for each of the below subtasks for the Design Memorandum summarizing the input parameters, calculations, and recommendations.

Preliminary Rising Main Design | In addition to the design memorandum, our team will develop a plan to summarize the review of existing data available via public records, PWSA-supplied documents, and the records of the various utility companies, authorities, and municipalities. To supplement the desktop study of available records, we will conduct an initial field study of the concept corridors to verify that conditions remain the same as identified within the 2016 Lanpher Rising Main Feasibility Report and to document any additional physical features present within the work limits.

Additionally, Michael Baker will use our experience in the project vicinity gained during our work within the Route 28 corridor, various geotechnical studies, and ongoing work with the Highland Park Interchange and the Ravine Street Stream Removal Project in Sharpsburg Borough. Our team has direct knowledge of the area from past work assignments and can offer significant relevant insight into challenges and opportunities for the best possible route selection. In conjunction with the initial route analysis, the team will look for opportunities to implement green infrastructure along the route. While not a specific requirement of the project, Michael Baker understands the need for sustainable solutions to be presented as part of any project that the PWSA undertakes. At this stage, the green infrastructure will be evaluated in areas where stormwater flows collect at highest concentrations to allow for the most "bang for the buck" solutions to be developed in the future. While this approach will satisfy two of the three considerations of the triple bottom line approach, economic and environment, we cannot forget the last tenant, equity. We will evaluate the location of green infrastructure as a function of providing social equity in whom it displaces, as well as the availability of any amenity it will add to the urban landscape.

Once complete, the results of our evaluation, studies, and field views will be compiled in a Design Memorandum with the accompanying set of conceptual design drawings to illustrate the preferred route as recommended within the memorandum. The report will provide a clear and concise evaluation of the current concepts, constraints, and issues with regards to the two options studied. Additionally, we will use the knowledge gained during this phase to offer any alternates and enhancements to the route(s). This will form the draft report for PWSA review and evaluation. While under review, Michael Baker will prepare the presentation materials for a community and stakeholder workshop to review the project and the options for routing the line. Upon concurrence of the PWSA, the workshop will be conducted prior to the completion of the report to capture the resultant public comment into the report to document the final recommendation for proposed route and associated analysis as to the reasoning for the route selected.

Preliminary Design Report - Geotechnical Services | Michael Baker will perform a preliminary geotechnical study of the area and conduct a literature review of available geology and geotechnical information for the area to supplement information provided in the Feasibility

Study. Michael Baker will review available information related to local soils, USDA soil survey mapping, geology, geologic hazards, PA Geological Survey reports, and existing test borings, as well as any records of foundations in the area and alternatives under consideration. Historical topographic maps and aerial photographs will also be reviewed. City of Pittsburgh, the PWSA, Allegheny County, ALCOSAN, PennDOT, Norfolk Southern Railroad, and other sources of relevant historical/archived records will be investigated. Based on our extensive work in the project area, Michael Baker already has many of these historic test borings in our possession, which will allow for incorporation of subsurface data into the Preliminary Design Phase. Michael Baker will also conduct a detailed site reconnaissance to note all pertinent geotechnical features on the site and confirm information garnered from the literature review and historical information.

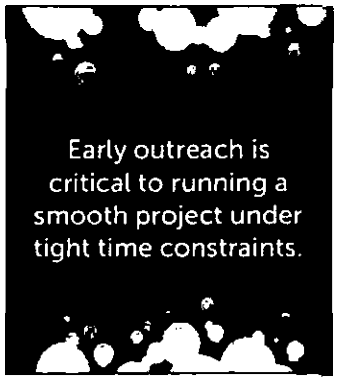
This task will include the preparation of a Geotechnical Summary which will be presented within the Preliminary Design Report. This summary will present the findings of the literature review, geotechnical constraints, and provide preliminary recommendations to support the factors considered during the sizing and preliminary route evaluation, which include but are not limited to: factors affecting constructability and cost; permitting; risk assessment; geotechnical constraints; construction techniques; construction duration and potential delays; utility, roadway, and railroad impacts; trenchless crossings; easements required; and ability to obtain easements. Intrusive Geotechnical investigation will not be performed in this Phase of the project; instead, we will utilize the existing test boring data and information obtained during literature review and reconnaissance to provide preliminary recommendations.

Based on these reviews and a site reconnaissance, a draft subsurface investigation plan will be developed and presented in the Preliminary Design Report that will be implemented during 30 % design phase once proposed design components have been established.

The Preliminary Design Report will include:

- Preliminary soil, groundwater, and bedrock information of the project area based on available records.
- Existing structure foundations, to the extent this information is available.
- Preliminary geotechnical recommendations relative to the proposed alternatives.
- Recommendations for geotechnical investigations for final design

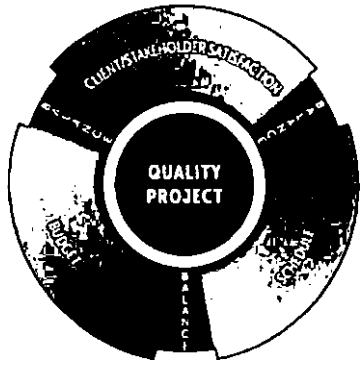
E. WORKSHOP



The Michael Baker team will hold a community workshop with the PWSA to discuss the findings from preliminary design activities and review the potential routes consistent with the **Triple Bottom Line** Approach. The workshop will provide the primary vehicle for the equity portion of the approach by giving the residents that will be impacted by the project a voice in the process. Working hand-in-hand with the PWSA, Michael Baker will develop and execute a workshop that will foster a greater understanding of alignment challenges and a consensus of the preferred alignment for the redundant rising main. The results from the Preliminary Design Workshop, including the PWSA's decision on the selected route, will be incorporated into an amended Preliminary Design Report. Additionally, because meetings with the affected municipalities (the boroughs of Etna, Aspinwall, and Sharpsburg, and Shaler Township) did not occur during the Feasibility Study phase of this project, the Michael Baker team proposes to have early coordination/outreach meetings, as described below under the Municipal/Public Coordination Section of Task 2: Final Design and Permitting.

DEMONSTRATED ABILITY TO IMPLEMENT A QUALITY APPROACH AND DELIVER QUALITY PROJECTS

Like the TBL philosophy, a "Quality Project" requires a managed balance of client/stakeholder satisfaction, budget adherence, and schedule adherence. Michael Baker's success in delivering this balance of project quality measures is a direct result of our experienced project managers' actions, a tenacious approach to project management process, creativity, and communication. On the technical and project controls side, we have proven our ability to control costs while maintaining a high level of responsiveness and dedication to meeting project schedules, technical quality, and constructability.



Our primary objectives for the Aspinwall Pump Station to Lanpher Reservoir Rising Main is to be responsive to the needs of the PWSA and other key stakeholders (city Pittsburgh, Aspinwall, Sharpsburg, and Etna Boroughs and Shaler Township residents and business owners), minimize interruptions and stakeholder impacts and to continue to provide high quality, cost-effective projects on time, all while meeting the PWSA's technical and operational requirements.

Our experienced team relies on sound engineering judgement to establish realistic schedules, taking into account review time for the PWSA, as well as jurisdictional agencies and their permitting requirements for each stage of the project. We develop construction costs estimates utilizing our experience, taking into account the complexity of the project, while obtaining quotes from suppliers, and discussions with contractors regarding market conditions (amount of work being performed and projected to be bid in the near future).

Forging a strong relationship of trust with key stakeholders is imperative to a successful quality project. Michael Baker has established working relationships with nearly every municipality in the project area. We have completed over 100 miles of water, gravity sewer, and force main pipelines and pump stations throughout the Pittsburgh Region. Michael Baker has worked closely with the PWSA for 30 years. These projects included significant stakeholder coordination and public outreach meetings and briefings with residents and businesses, private utility and railroad companies, and regulatory agencies, as well as the frequent interaction with City Department of Public Works (DPW) during design and construction.

TASK 2: FINAL DESIGN AND PERMITTING

A. SURVEYING OF PROPOSED ROUTE

The Michael Baker team will identify the limits for surveying and perform the survey, in North American Datum of 1983 NAD83 (CORS) SPCS PA South U.S. Survey Feet with elevations referenced to the NAVD 88 U.S. Survey Feet. The survey will include the following information:

Roadway Information
- Edge of pavement
- Centerline of roadway
- Right-of-way lines (per available GIS mapping to be provided)
- Visible drainage, sewer, and utilities

Utility Information
- Alignment/location of electric lines
- Alignment/location of telephone lines
- Alignment/location of cable lines
- Alignment/location of gas main, valves, and boxes
- Utility poles
- Water distribution lines, valves, meters, hydrants, and service laterals
- Sanitary/storm sewer locations (including size, material, top casting, and invert elevations)

General Information
- Drives and sidewalks
- Edge of parking areas
- Edge of woods (if applicable)
- Trees 2 inches in diameter and greater
- Bushes and shrubs
- Perimeter of landscaped areas
- Mailboxes
- Fence lines
- Signage
- Roadway and driveway culverts and headwalls
- Property lines (per available GIS mapping to be provided)
- One-foot contours

With the understanding that "time is of the essence," one of the most critical items to project success is to accurately capture the project conditions that the design will need to work within. The faster the team can gain a clear understanding of the constraints that are present, the more readily the concept design can begin to take shape. For this reason, Michael Baker will employ some innovative techniques to the project survey. The initial topographic survey will be conducted using our mobile LiDAR vehicle. These vehicles provide a 3D scan of the project corridor to a survey level of accuracy and capture all the existing conditions and physical constraints. At the onset of the survey process, our survey team will set control for the project that will establish the vertical and horizontal datum to be used throughout design

and construction. Semi-permanent horizontal and vertical control monumentation along the route will be established by a combination of RTK GPS, Total Station, and Digital level at a horizontal tolerance of less than 0.05 feet and a vertical tolerance of less than 0.03 feet using 95 % confidence levels. This will ensure the appropriate level of accuracy will be achieved both during design and through construction.

There are several benefits to this approach; first, the use of LiDAR scanning provides a complete dataset of the all physical features. This is significant because we will capture all the existing data within the corridor in the initial data collection in a fraction of the time of conventional survey. This data can be combined initially with the record utility information to allow the concept plans to be developed early in the project timeline. The data collected will typically capture all existing features including:

- Utility poles and overhead wires
- Signs and street/pedestrian delineators
- Pavement width, curbs, sidewalks, crosswalks and cross streets
- Manhole lids and storm inlets
- Adjacent structures and residential and commercial building fronts
- Overhangs
- Vegetation and tree areas

Second, the time required to collect the comprehensive survey of the topographic features is significantly less than a traditional survey. We believe that the corridor could be scanned in a matter of one to two days. This assumes that we would be able to coordinate with the local municipalities to clear the corridor of on street parking for the day that data collection would take place. The creation of a working CAD file from the data does not take any longer than traditional survey, thus the time savings of almost three weeks is significant.

The remaining survey effort to collect the utility information would coincide with the SUE effort since the remaining information to gather is all underground items that will be part of the SUE scope to identify and map. This effort will utilize a traditional total station methodology and would follow closely the schedule for the SUE effort.

We feel that driving this type of innovation into the design process for the PWSA creates a superior design deliverable, as well as providing value in the form of a more compressed design schedule. Additionally, this approach is a prime example of how we are implementing the triple bottom line approach in every aspect of the project. This type of innovation provides a significant economic value to the project both in time savings and actual cost of the survey effort. Additionally, the data that is collected will provide a comprehensive model that will allow for the future development of additional survey without the need for added field time.

SUBSURFACE UTILITY EXPLORATION (SUE)

Subsurface Utility Engineering (SUE) is the art, science, and technology of obtaining reliable information about public and/or privately-owned subsurface utilities and surface utility features through the process of geo-prospecting (horizontally marking utilities), data interpretation, documentation, and utility test holes.

We have partnered with JMT Engineering to provide the full SUE services for the project. JMT brings significant SUE experience to the project team. SUE mapping products will be used to effectively plan for future construction, alignment constraints, site characterization spatial analysis, permitting, mitigating construction change orders, public safety, and record documentation. Our team of professionals are experienced with a broad range of technologies and their respective applications in any project environment to assure we will exceed expectations. Work for this project



JMT has full SUE capabilities based in Pittsburgh with extensive railroad coordination experience having worked on SUE projects for PWSA and PennDOT.

will be planned, implemented, and completed under the direct supervision of a Subsurface Utility Engineer utilizing the American Society of Civil Engineering CI/ASCE 38-02 Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data.

Subsurface Utility Engineering services use a wide range of electromagnetic radio frequency instruments and ground penetrating radar (GPR) for most applications. Project staff is required to maintain a rigorous training and safety program to assure the proper use of these instruments and safety procedures. **The SUE team assigned to carry out this project includes professional engineers, licensed surveyors, subsurface utility locators (designators), survey technicians, CAD/GIS technicians, and all associated equipment. Additionally, our team brings extensive experience coordinating with both CSX and Norfolk Southern.**

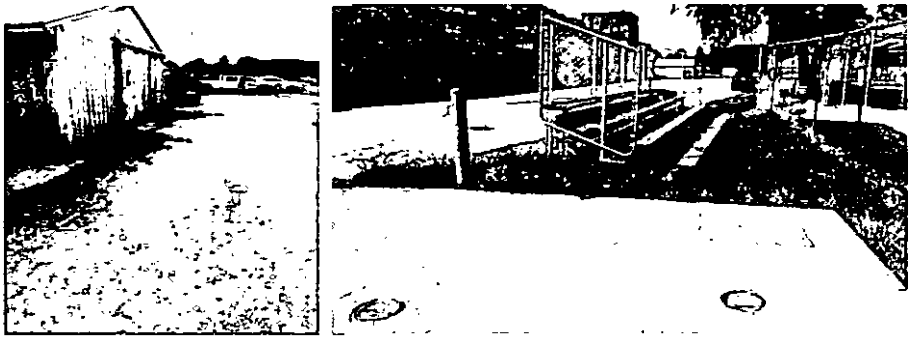
Permits will be obtained from the following agencies for utility test holes: PennDOT, Hampton Township, Shaler Township, Aspinwall Township, Pine Creek, Millvale Borough, and Sharpsburg Borough. The Michael Baker team will contact Norfolk Southern Railroad (and CSX if necessary) and make appropriate arrangements to access all railroad crossings for utility designation and utility test holes. We will reduce costs by planning utility test holes in groups. This will reduce the time associated with applying for permits and reduce the total number of permits needed. If test holes can be conducted outside the paved areas, but within the road right-of-way, additional savings can be implemented.

QUALITY LEVEL "D" UTILITY RESEARCH

The Michael Baker team will utilize a One-Call design ticket, utility recollection, above ground utility appurtenances, and private utility information to collect publicly- and privately-owned utilities within the project limits. Known utilities impacted are as follows: AT&T, Comcast, Windstream, Verizon, Aspinwall Borough, Alleghany County Sanitary Authority (ALCOSAN), People's Gas, Pittsburgh Water and Sewer Authority (PWSA), Girty's Run Joint Sewer Authority, Hampton Township, Shaler Township, Etna Borough, Duquesne Light, and Sharpsburg Borough. We are aware of major utilities that will be impacted during the design to include a 72-inch sewer line, 48-inch brick sewer, abandoned 96-inch filtered water conduit, 72-inch sewer and a 96-inch filtered water conduit. It is anticipated that non-member utilities and private utilities will be impacted by this project. We will utilize our established relationships within the municipalities involved and with the utility companies present to coordinate our work in advance of any work and to request any as-built plans or utility maps available.

QUALITY LEVEL "B" UTILITY DESIGNATION

The Michael Baker team will horizontally mark and identify known underground utilities that are provided on utility record mapping, verbal recollections, and/or that are evidenced by existing surface appurtenances within the project boundaries. We recognize the many challenges of this project including the diverse work environments for SUE collection. Our team has an extensive background working in highway, heavy and light industrial, and residential and business areas, which are present along both proposed alignments. As evidence of this, **JMT's SUE Group played an active role in mapping the existing 60-inch water mains, utilities, and associated vaults at the Lanpher Reservoir**. JMT's SUE experience also includes the Etna Riverfront Trail Project (William Flynn Highway and Bridge Street) along one of the 60-inch water main proposed routes. Additionally, JMT's SUE group previously provided utility designation and utility test holes within the areas indicated on the following map.



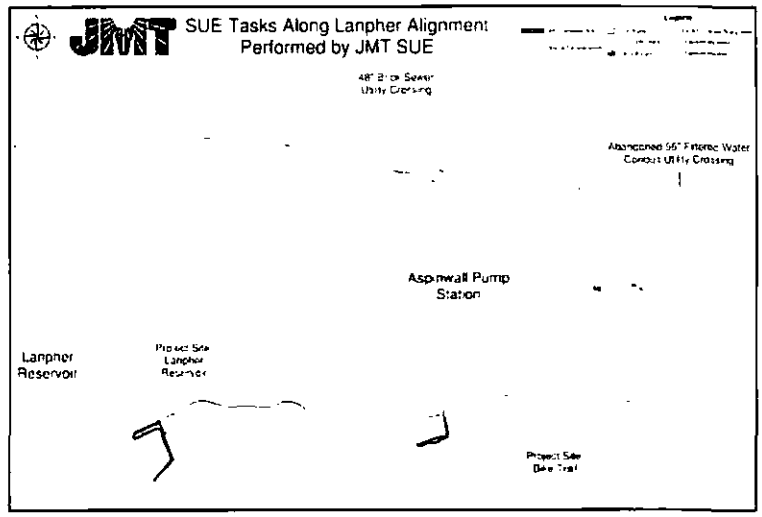
JMT recently performed SUE services at Lanpher Reservoir

We anticipate utilizing many techniques and technologies to map underground structures such as brick sewers, abandoned lines and subsurface structures. Conductive "toneable" utilities (i.e. those utilities able to have a radio frequency induced or otherwise imparted onto them) will be identified using geophysical prospecting techniques in conjunction with Radio Frequency Electromagnetic Induction pipe and cable locators (RFEMI). A utility sweep will be performed to investigate the presence of unknown utilities. The utility sweep will include Radio Frequency Electromagnetic Induction pipe and cable locators utilizing inductive methods and passive frequency methods. GPR is used to map nonconductive materials and/or structures when soils are suitable. Utilities and linear features will be marked in the field utilizing

standard marking paint and/or flags in accordance with APWA, CGA, and ASCE 38.02 guidelines. Field information will include all surface utility appurtenances and the horizontal position of the designated utilities. The data is collected using field survey methods by total station; Global Positioning System (GPS) utilizing the survey control will be provided by the survey team within the limits of the investigation. The interpreted result extracted from the geophysical data obtained by this method is integrated into the final CADD deliverable.

QUALITY LEVEL "A" UTILITY TEST HOLES

The Michael Baker team will perform test holes at various locations throughout the site to determine depths of utilities present along the selected alignment. We will propose test hole locations for major known utility conflicts designated by the Quality B process with the approval of the PWSA. Our team will notify One-Call 48 hours in advance of excavation and acquire all applicable permits. We will establish test hole locations in the field utilizing above ground features provided on plan sheets using survey methods and RFEM designation equipment. Vacuum excavation will be applied to expose utilities to minimize any potential for damage. Test holes performed will be of minimum size (usually 1-foot by 1-foot). We will use survey to provide the final horizontal and vertical information. A test hole summary sheet will provide information to include approximate size, type, materials, horizontal coordinates, and vertical elevation. A CADD file will be provided displaying horizontal locations of each test hole performed in the field. Backfill of test holes will be performed using material removed, if suitable. Areas will be returned, as close as possible, to their original condition. Test holes performed in the street will be patched using cold patch. The team anticipates brick and/or cobblestone roadway surfaces within the project limits. These areas will be returned, as close as possible, to their original condition using existing materials (brick and/or cobblestone). Our experience with previous test holes in this vicinity indicates that placing brick or cobblestone back in the test hole was unnecessary, as it was not the preference of the municipalities to maintain cobblestone streets. We will continue coordination with the municipalities to determine specific requirements for restoration. The proposal team will provide maintenance of traffic and traffic control plans as needed.



SUE tasks performed by JMT SUE team along Lanpher Reservoir, proposed project site, and special considerations

Coordination with Surveyors | The Michael Baker team will ensure that our survey efforts and the SUE are coordinated. Every effort will be made to minimize delays between SUE field work completion and collection of survey data.

QA/QC | The Michael Baker team will perform QA/QC on the collected data to ensure accuracy. Coordination will be made with the surveyors to facilitate any necessary corrections or changes to the underground utility mapping or test hole information.

The Scope of Work includes the following:

- The Michael Baker team will be responsible for providing Maintenance of Traffic using signs and cones, only as deemed necessary, to perform the work during normal daytime operations.
- The Michael Baker team will coordinate all operations with the client.
- The Michael Baker team will designate and mark the approximate horizontal location of conductive underground utilities as denoted above. Conductive is defined as any utility capable of conducting an electromagnetic tone. GPR will be deployed to designate non-conductive utilities.
- When test holes are included, the Michael Baker team will contact the PA One Call System, as required by law, before excavating.
- The Michael Baker team will obtain the necessary test whole permit before excavating test holes, if required.
- The test holes will be backfilled and compacted in 6-inch lifts with the same material that is excavated.
- If the test hole has been excavated in pavement then it will be restored with cold patch material to the same depth as the pavement that was removed.

B. PHASE I ENVIRONMENTAL ASSESSMENT

Phase 1 Environmental Assessments | The Phase I ESA will be performed by the Michael Baker team in accordance with requirements contained in the American Society for Testing and Materials (ASTM) Practice E 1527-13 and will build off the Environmental screening performed during Preliminary Design. The study area will include a roughly 15-feet on either side of the proposed pipeline route. The Phase I ESA will research and summarize readily available current and historical information about the project site and adjacent properties to identify potential recognized environmental conditions (RECs). Specifically, the Phase I ESA will identify general site conditions, operations, and historical occurrences that may have resulted in the release of hazardous materials, petroleum products or other environmentally sensitive materials.

This Phase I ESA will consist of the following components:

- A review of readily available environmental records and published environmental databases relevant to the project site
- A site reconnaissance
- Summary of soil/geologic/hydrogeologic setting, based on the literature and field observations
- Personal interviews with the property owner (or their designated representative) and select government officials
- A PADEP file review at their Southwest Regional office.
- A written report of findings

Upon project initiation, it is assumed that the PWSA will provide Michael Baker team (in a timely manner) with the following User Provided Information, as per ASTM:

- Parcel numbers, address and coordinates
- Copies of the current property deed, any other available title information, and list of environmental liens (if any)
- Reason for significantly lower purchase price compared to appraisal price (if applicable)
- The name and contact information for the property owners and/or representatives who are knowledgeable about the environmental and operational history of the properties, who will facilitate the site reconnaissance and grant access
- Other files (e.g., environmental reports, geotechnical reports, permits, correspondence) that are relevant to the Phase I ESA and available to the PWSA

Phase I ESA - Records Review

Michael Baker will use a commercial environmental database service (e.g., Environmental Data Resources, Inc.[EDR]) to provide a summary of available federal, state, and local environmental databases. Radial search distances will be in accordance with ASTM E-1527-13. The Michael Baker team will also obtain and review, historical aerial photographs, Sanborn® fire insurance maps, historic United States Geological Survey (USGS) topographic maps and city directories, to the extent available. Deeds will be reviewed for evidence of institutional and engineering controls. Results of the records review, including photocopies of pertinent documents and a copy of the environmental database search, will be included in the Phase I ESA report.

Phase I ESA - Site Reconnaissance

The Michael Baker team will conduct a site reconnaissance of the project site and surrounding sites. It is assumed that the PWSA will get approval from the Owners for the Michael Baker team staff to inspect the properties. The reconnaissance will include a noninvasive visual inspection of the project site and adjacent properties to evaluate present site conditions and search for evidence of past activities that may pose an environmental concern. Available mapping will be used in noting locations of features of environmental concern. Additionally, photographs of general site conditions, adjoining properties and areas/features of concern (if any) will be obtained for inclusion in the Phase I ESA report.

No special health and safety protocols are anticipated for this activity; however, our field staff that are assigned to this project will have been trained in accordance with OSHA rule 29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response (HAZWOPER).

Asbestos, lead-based paint, lead in drinking water, wetlands, endangered species, cultural resources, mold, and radon/indoor air quality will not be considered formal parts of this ESA (these items are beyond the scope of a typical Phase I ESA). However, general observations concerning these issues will be discussed in the report, as appropriate. This Phase I ESA will not include an audit of property/facility operations or a determination of permit compliance.

Phase I ESA – Preliminary Soil Screening and Geologic Characterization

The Michael Baker team will create a site-specific soil data report from the U.S. Department of Agriculture (USDA) soil survey web-site. Other geologic and hydrogeologic data will be summarized based on a review of published geological information from the USGS, Pennsylvania Geological Survey and other sources. Additionally, observations of exposed soils will be made and photographed during Task 2. Results of the soil screening/geologic characterization, including photocopies of pertinent documents, will be included in the Phase I ESA report.

Phase I ESA – Interviews

The Michael Baker team will conduct surveys and/or telephone interviews with knowledgeable personnel identified by the PWSA. Additionally, public officials will be interviewed, including but not limited to, a representative of the fire department/emergency management personnel (if responsive). The results of these interviews will be summarized in the Phase I ESA report.

Phase I ESA – PADEP File Review

Michael Baker will evaluate PADEP records available on the eMapPA Web site. Based on the findings of this on-line review and the EDR database report, a formal file review will be scheduled with the Southwest Regional Office (SWRO) of PADEP in Pittsburgh for the site and for any adjacent sites immediately upgradient of the Site. Please note that file reviews can take a month or more to schedule with the SWRO depending on their case load at the time of the request.

Phase I ESA - Report

A Phase I ESA Report will be prepared for the pipeline corridor from the information gathered from the records review, interviews, database review, site reconnaissance, and file review. The report will include recommendations for additional subsurface soil investigations to determine if special handling of soils will be required during excavation of the trench for the proposed pipeline. Michael Baker will provide an electronic copy of the report to the PWSA. It is assumed that hard copies of the report are not required.

C. GEOTECHNICAL INVESTIGATION

Geotechnical Investigation | Existing Conditions | Lanpher Redundant Rising Main project is located within the boroughs of Etna, Sharpsburg and Aspinwall, in Allegheny County, Pennsylvania. Project Alternates (Alternative Alignment 2 and Alt_Route_2rev1 shown in Figure 1 and Figure 2 of RFP) start at the Aspinwall Pump Station, travel along city streets and PennDOT roadways (SR 1001 Freeport Road) along relatively flat gently sloping floodplain of the Allegheny River and end at Lanpher Reservoir.

Preliminary geology review of the project site indicates that soils in the vicinity of project has been identified by the NRCS as UB – Urban Land; UCE – Urban Land Urban land-Culleoka complex, steep; URB – Urban Land – Rainsboro complex, gently sloping; GQF - Gilpin-Upshur complex, very steep; and ErC - Ernest silt loam, 8 to 15 % slopes, which are all landslide susceptible soils. The prominent soil type is urban land along the Allegheny River floodplain within Aspinwall and Sharpsburg boroughs. The floodplain is generally covered with variable urban fill, which is underlain by glacial outwash and recent alluvial deposits consisting of mixtures of clay, silt, sand, and gravel. The approximate depth to bedrock within the floodplain varies from 25 feet to greater than 70 feet but will be shallower for alignment portions outside the Allegheny River floodplain.

The site elevations range from 980 feet at the top of the valley at the Lanpher Reservoir and approximately 720 to 760 feet along the floodplain. The project site is located below the Pittsburgh coal seam and a geologic hazard of mine subsidence is not anticipated.

The Ames limestone outcrops at approximate elevation 925 feet on the valley slope below the Lanpher Reservoir. Stratigraphically, the lower limits of the slope below Lanpher Reservoir and above the SR 28 Roadway Corridor is within the Pittsburgh red bed unit, a slaking claystone unit. Red beds typical extend 25 feet above Ames limestone (Unnamed red beds – 925 to 950 feet) to 50 feet below (Pittsburgh red beds

925 to 875 feet). The Pittsburgh red beds are historically associated with landsliding and deep-seated stability issues and the USGS has identified the Allegheny River valley slopes as having soil and rock materials susceptible to landsliding.

Three tributary streams to the Allegheny River exist with the project limits, which include Pine Creek in Etna, Seitz Run in Park View Valley associated with SR 1003 (Canal Street and Kittanning Pike), and Guyasuta Run Stream just west of Highland Park Interchange. Seitz Run and Guyasuta Run have been captured in culverts and piped to the Allegheny River. Guyasuta Run has one limited area of open channel just north of Freeport Road in Sharpsburg. There have been recent accounts of flooding associated with this tributary stream valley in Sharpsburg.

Our existing Geotechnical knowledge of the project area will allow us to complete Preliminary and 30% Design without conducting test borings at this phase of the project.

Michael Baker is working with PennDOT on the Highland Park Interchange Improvement and Ravine Street Stream Removal Projects. These projects help build a strong knowledge and understanding of the subsurface conditions in the project area. Our understanding of the subsurface conditions on these projects includes the following: Deep soils along the Allegheny River Floodplain due to past river channels and river downcutting; Deep soils greater than 60 feet along Freeport Road; and active deep-seated landslide along Noble Street in Sharpsburg. Pennsylvania.

60% DESIGN PHASE

Final Design - Geotechnical Services - 60% Design | Michael Baker will conduct a geotechnical subsurface exploration to support the design and construction of the proposed rising main. The objective of the geotechnical subsurface investigation is to obtain information on subsurface condition at the project site and collect soil and rock samples for laboratory testing. Michael Baker will team up with AWK Consulting Engineers to conduct a geotechnical subsurface investigation and laboratory testing.

Drilling and Testing Investigation Program | The proposed geotechnical subsurface exploration program will consist of drilling 81 test borings, which includes the following:

45 borings spaced approximate every 500 feet along the alignment with an average depth of 20 feet; 900 lineal feet

- Trenchless crossing 1: 3 borings approximately 40 feet deep; 120 lineal feet
- Trenchless crossing 2: 3 borings approximately 30 feet deep; 90 lineal feet
- Trenchless crossing 3: 10 borings approximately 45 feet deep; 450 lineal feet
- Borings to investigate alternate route: 20 borings approximately 25 feet deep; 500 lineal feet

A draft boring plan that reflects the boring approach is included in this proposal and a final boring location plan will be submitted to the PWSA prior to the start of the drilling. The proposed drilling program includes 2,060 lineal feet of drilling. For estimating purposes, 30 feet of drilling per day per drill rig is used to determine the drilling duration. Two drill rigs are anticipated to complete the drilling in less than 40 working days. Drilling will be monitored by a Michael Baker and AWK qualified field engineer or geologist on a full-time basis. Field boring logs will be prepared to include soil and rock classifications, standard penetration tests (SPT) blow counts, pocket penetrometer readings, and depths of ground water table.

Upon completion of the drilling, Michael Baker will evaluate the results of the investigation and develop a final laboratory testing program. The laboratory testing program will include testing to obtain engineering properties of soil and rock. The laboratory testing program will include determination of soil classification, grain size, unconfined compressive strength, moisture content, and soil corrosivity. Rock testing will be performed on selected samples to determine compressive strength.

The boring locations will be surveyed as part of a separate task prior to drilling investigation. Maintenance and Protection of Traffic (MPT), PennDOT Highway Occupancy Permits, and Borough Permits are anticipated for the drilling investigations within the PennDOT Right-of-Way and city streets and will be coordinated with PennDOT and boroughs.



Final Geotechnical Engineering Report | This task will include the preparation of a Final Design Geotechnical Engineering Report. The report will include the findings of geotechnical investigation and the laboratory testing program.

The Final Geotechnical Engineering Report will also include soil design parameters to be used in temporary shoring design. Additionally, the report will present soil subsurface characteristics, bedrock structure, groundwater condition, laboratory tests results, recommendations for corrosion protection, control of ground movement, excavation methods, available working space and staging areas, and handling and disposal of excavated materials for cost estimating. In addition, PennDOT requirements for trenchless crossings 1, 2, and 3 beneath Freeport Road, Highland Park Interchange, and Etna Interchange will be addressed. A final report will be will be signed and stamped by a registered Professional Engineer licensed in the Commonwealth of Pennsylvania.

90 % DESIGN PHASE

Geotechnical Services - 90% Design | Michael Baker will provide geotechnical review of the final plans, specifications, and cost estimate. The review of the final plans will be conducted to assure geotechnical recommendations are implemented and are included in the submission. Any geotechnical review comments on the 60 % design submission will also be addressed in this phase of the project. Geotechnical personnel will be available, as requested for Workshop, to review the 90 % design and comments.

100 % DESIGN/BID READY PHASE

Geotechnical Services - 100 % Design/Bid Ready Phase | Michael Baker will provide geotechnical review of final design calculations, any Final Design Memorandums, specifications, construction schedule, sequence of construction, cost estimate, and bid sheets.

DIFFERENTIATOR

EXTENSIVE QUALITY CONTROL PROGRAM

Michael Baker has partnered with JMT Engineering to provide full quality control services as part of our proposed solution to the PWSA. There is significant value in adding JMT with their extensive experience in this role for the DC Metro water utility and current work being performed for the PWSA. The value added is an assurance that well-qualified professionals are performing a third-party review prior to the submission reaching the PWSA. This will reduce review times, expose any design issues, and control the need for changes throughout the design process.

PRELIMINARY DESIGN REPORT AND ALIGNMENT SELECTION QUALITY CONTROL

The Michael Baker team will perform internal quality control reviews to assist in the design analysis and provide cost-effective and sustainable long-term solutions to the PWSA for the Redundant Lanpher Rising Main. We have reviewed the Mott-MacDonald Lanpher Rising Main Feasibility Report, and will evaluate the additional design criteria during preliminary design and utilize to rank alternatives, as follows:

CONSTRUCTABILITY

Several construction methods, materials, and pipe sizes are required to build the Redundant Lanpher Rising Main. Each of the methods has various constructability challenges that require evaluation to mitigate concerns such as excess labor, cost, schedule impacts, and disturbance to land and residents.

Construction Methods | Open-cut construction is the most common for waterline installation, but has the greatest impact to roadways, and therefore, will require detailed erosion and sediment control and roadway restoration design. Trench depths and widths required for various pipe sizes and the feasibility of constructing them will be evaluated and compared to trenchless installation methods. Limiting the installation depth will most effectively mitigate these concerns but is not feasible in utility congested roadways. Compounding this installation, other typical utilities (i.e. gas, electric, telecom, etc.) are present in this 3- to 6-foot depth range that will need to be avoided.



DC Water, Oregon Avenue Project - longest single drive micro-tunneling operation on the United States east coast (1,866 LF of 36" pipeline)

Trenchless construction will be required for a minimum of three sections along each proposed alignment route due to highway corridors and environmentally sensitive areas. The Michael Baker team will evaluate the selected trenchless construction methods to ensure all factors affecting the design are incorporated, including bend radius for horizontal and vertical alignment, required laydown area and access shafts, and congruence with selected pipe materials. The Michael Baker team will verify that industry best practices are followed for the following trenchless technologies:

- Horizontal Directional Drilling (HDD) - The Michael Baker team will evaluate bend radius for horizontal and vertical alignment, length of HDD, laydown area, and pipe materials applicable. The most common material for HDD is fusible HDPE. However, the Michael Baker team does not recommend HDPE for drinking water pipelines as the material degrades with chlorination. Additionally, HDD will create a low point in the alignment without access for a blow-off to drain or clean the line.
- The following additional trenchless pipeline installation techniques will be evaluated for constructability: auger boring, microtunneling, pipe jacking, and TBM. These methods require casing pipes and entry/receiving pits but have a high level of accuracy for alignment design. JMT recently completed the design and construction phase of the longest single drive micro-tunneling operation on the United States east coast – 1,866 linear feet of 36-inch pipeline in Oregon Avenue for DC Water. The project was designed to allow the contractor to align multiple trenchless installation setups together if the equipment and conditions would allow. The success of this project relied heavily on the JMT team's ability to depict soil conditions and existing utility mapping of the site. The Michael Baker team will use the knowledge

gained on that project and assist in determining if the Redundant Lanpher Rising Main can be constructed with similar trenchless methods.

- JMT is also currently working on 48-inch jack and bore designs under major high-speed rail lines in coordination with national contractors to verify the constructability of more than 400 linear feet drives in high-risk locations. The Michael Baker team will use our network of reputable contractors to verify all construction methodologies presented, verify construction footprints, and mitigate disturbance as much as possible.
- Casing pipe sizes will be evaluated to determine if manned-entry methods can provide a cost savings and alleviate risk.
- Depth will be evaluated to ensure clearances from all existing utilities are maintained and verify that no disturbance from earth heave, or settlement from poor soils such as running sands will occur.

Construction Materials | The major factor in large diameter pressure pipeline that affects constructability is thrust restraint. Concrete thrust blocks and collars are common practice in small diameter main construction but can become sizeable and not cost effective or schedule-friendly to construct on large diameter mains. Pipe materials vary in their ability to have mechanical restrained joints, and the Michael Baker team will review all proposed material methodologies to ensure the constructability of all restraint systems.

Alignment Analysis | The Michael Baker team will review all proposed alignments to determine if horizontal and vertical alignments are clean and remove additional fittings that are not required or do not add value to the design. Additionally, the location of the alignment in the roadway or easement will be reviewed for traffic concerns and future maintenance access.

REDUNDANCY AND HYDRAULICS

While the proposed Redundant Lanpher Rising Main is anticipated to provide complete redundancy for the existing 60-inch steel pipeline, the pipe is nearing 100 years old with original construction in the 1920s. The remaining useful life of the original Lanpher Rising Main is in question, and for the purposes of redundancy, the proposed pipeline should be designed to operate as the sole water main supply for the north side of Pittsburgh. To extend the life of the original Lanpher Rising Main, it will need to be taken out of service and rehabilitated or repaired. As such, the hydraulics of this system will be evaluated to operate under several flow scenarios, with one or both pipelines in operation.

Redundancy and Resiliency | The Michael Baker team will evaluate the selected alignment designs for redundancy and ability to provide complete isolation. Complete isolation will require more than valve placement at each interconnection to the existing Lanpher Rising Main and at each service connection along the alignment. Additional qualifications will be reviewed for redundancy and resiliency of the system:

- Access Port locations for valve maintenance, future isolation, cleaning, and inspection
- Valves will need to be designed to operate under full pressure scenarios with bypass piping likely
- Evaluate if additional interconnections are required
- Evaluate pipe material selections and coatings for the longest design life suited to the project area (Corrosion design and cathodic protection may be required in sections, as well as newer pipe materials such as zinc coated ductile iron and V-Bio enhanced polyethylene encasement.)

Hydraulics | The Michael Baker team will perform hydraulic analysis of the system under multiple design scenarios. A full scope of hydraulic modeling is provided in Task 2. Additionally, the Michael Baker team will review:

- Locations of all blow-offs for hydraulics and for draining and cleaning purposes
- *Design of future connections and feasibility of wet tapping the active main*

CONSTRUCTION COST

As part of the preliminary design submittal, construction costs will be evaluated and ranked for multiple materials and design alignments. The following will be reviewed at a minimum for preliminary alignment alternatives:

- Pipe Diameter – best practices for 48-inch and 36-inch pipelines and availability of fittings and valves or need for special ordered fittings
- Size and location of access pits to limit excavation where possible (Use one access pit for multiple purposes)
- Thrust restraint – review of restrained joint pipe vs. concrete costs for thrust blocks and collars
- Norfolk Southern Railroad Corridor – cost of sheeting/shoring within right-of-way to meet AREMA guidelines for E-80 loading
- Pipe materials – DIP, PCCP, steel installation practices, and cost savings

COMPLEXITY AND RISK OF TRENCHLESS CROSSINGS

Preliminary design services will also include a desktop analysis of proposed trenchless construction limits. The Michael Baker team will assist in the evaluation of trenchless crossings to mitigate permitting and construction concerns for the following:

- Environmentally sensitive areas, wetlands, streams, and forested areas
- Heavy traffic roadways that will not allow open cut construction
- Railroad and utility corridors
- Shallow rock or cobble through review of boring locations and results
- Environmental hazards and contaminated properties
- Available area for placement of launching and receiving pits

Risk | The Michael Baker team will assist in risk mitigation for the proposed alignment. Water main best practices will include access port spacing for future maintenance and cleaning, as well as congruence with required ARV (air release valve) locations, CAV (combined air vacuum valves), and entry and exit pits for trenchless crossings. Best practices to mitigate risk along the alignment include:

- Access vaults at a minimum spacing of 2,500 linear feet for cleaning and traditional inspection technologies
- ARV/CAV at a minimum spacing for isolation and air entrainment mitigation
- Access vault at the Aspinwall Pump Station (PS) for application of non-traditional free-swimming inspection technologies such as Pipe Diver
- Minimum trenchless installation sizing to allow for man-entry in case of equipment seizure

The RFP describes design of a new 48-inch rising main with reduction to 36 inches at each of the three proposed trenchless crossings as part of the approximately 22,500 linear feet rising main construction. The new 36-inch rising main will be installed within a 54-inch steel casing constructed using trenchless technology methods. The proposed trenchless methods will be further evaluated based on the additional geotechnical data and existing utility information obtained during design.

Pertinent attributes of the proposed trenchless crossings are summarized in the table below (an overall description of the trenchless methods is provided at the end of this section):

TRENCHLESS CROSSING NUMBER	LENGTH (FEET)	DEPTH TO INVERT (FEET)	PROPOSED TRENCHLESS METHOD(S)	REMARKS
1	180	22 to 28	Auger Bore or Pipe Ramming	▪ Alignment passes below two railroad tracks and Freeport Street ▪ Alignment passes below a 24-inch sanitary sewer, 72-inch storm, 96-inch filter water conduit, 24-inch emergency filter backwash pipe and a 20-inch gas main ▪ Clearance between bottom of deepest pipe and the top of proposed 54-inch casing is about 2 feet. ▪ Soil conditions consist of up to 10 feet of fill underlain by about 50 feet of glaciofluvial sediment ▪ Bedrock is greater than 75 feet below existing ground surface ▪ Groundwater ranges from about 10 to 25 feet below ground surface (it has been noted to be up to about 38 feet.) ▪ Jacking and receiving shafts depths are both about 30 feet.

TRENCHLESS CROSSING NUMBER	LENGTH (FEET)	DEPTH TO INVERT (FEET)	PROPOSED TRENCHLESS METHOD(S)	REMARKS
2	200	8 to 32	Auger Bore	▪ Alignment passes beneath State Highway 28 entry and exit ramps. Pile caps for Ramps A and B are offset from the steel casing and at or below the steel casing. Pile bottom depths below the steel casing are unknown ▪ No known buried utilities ▪ Soil conditions consist of up to 15 feet of fill underlain by about 50 feet of glaciofluvial sediment. Clay thickness of about 49 feet was encountered at recent boring east of the crossing ▪ Groundwater is about 45 feet below ground surface per recent boring east of the crossing ▪ Jacking/receiving shafts depths are about 9 and 19 feet below ground surface
3	365	8 to 14	Microtunneling	▪ Alignment crosses PA State Highways 8 and 28, Railroad and Pine Creek. ▪ Alignment passes below utilities (12-inch watermain, high pressure gas main, 36-inch sanitary sewer ▪ Bedrock (hard sandstone overlain by fractured shale) is about 20 to 30 feet below existing ground surface and about 5 to 8 feet below Pine Creek ▪ Groundwater is anticipated to be less than about 10 feet below existing ground surface ▪ Jacking and receiving shafts depths are both about 35 to 39 feet below existing ground surface.

Key Design/Construction Issues | The following sections highlight ways in which issues noted in the table can be successfully addressed to ensure constructible trenchless crossings.

Trenchless Crossing #1. The trenchless horizon is in saturated sand and silt with very low strength and will result in steering challenges. A support system such as pilot tube guide rails to support the pipe ram can aid steering. Alternatively, the pilot tubes can be used to guide the pipe ram, or if designed with grouting capability, can be used to improve the ground below the casing pipe invert to maintain grade. The pilot tube can also be used as a tool to probe ahead for obstructions, thereby providing an opportunity for removal or minor alignment modification.

To address very low strength soils, a focused test boring program will be required to better define the soil type and groundwater regime within the tunnel horizon. The program should include continuous sampling a tunnel diameter above and below the tunnel horizon. Laboratory testing will aid in classifying the soil and understanding of potential/applicable ground improvement methods (such as dewatering of ground modification).

Ensuring adequate spacing between the casing and the 96-inch pipe is paramount. A diameter or more will reduce the risk of encountering pipe bedding which could be a source water inflow in addition to compromising its support. The risk of encountering potential excavation support left in place is also lowered.

Trenchless Crossing #2. The trenchless horizon is primarily within stiff clay and above groundwater. To mitigate potential for obstruction within highway embankment, use a of pilot tube in conjunction with auger boring can be utilized as a tool to probe ahead for obstructions, thereby providing an opportunity for removal or minor alignment modification.

A test boring program with a focus on defining the soil type and confirming the groundwater regime within the tunnel horizon is warranted. The program should include continuous sampling a tunnel diameter above and below the tunnel horizon. Laboratory testing will aid in classifying the soil and understanding of potential/applicable ground improvement methods, such as need for soil conditioning to aid in removal of sticky clay from the augers.

Trenchless Crossing #3. The trenchless horizon is below groundwater primarily in the hard sandstone, about 8 feet from the bottom of fractured shale to the top of steel casing.

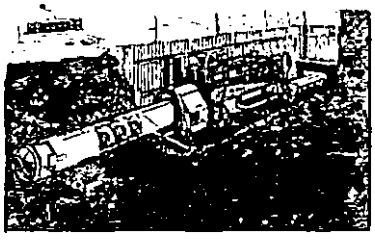
A test boring program with a focus on defining the rock type and confirming the groundwater regime within the tunnel horizon is warranted. The program should include continuous sampling a tunnel diameter above and below the tunnel horizon. Laboratory testing will aid in classifying bedrock to gain an understanding cutter head design and cuttings removal. Information from the test boring program will aid in design of the shafts which extend about 15 feet into bedrock.

Shafts: The envisioned trenchless technology methods above will require a jacking and a receiving shaft. Trenchless Crossing #3 will require excavation in soil and will transition several feet into bedrock. Elements of the excavation support system will socket into bedrock and will need to consider excavation of bedrock and stability.

Impacts to adjacent Structures | All three trenchless crossings will benefit from an assessment of impacts to existing structures (conduits, railroads, pile bents, roadways, bridge piers) during the installation of the 54-inch casing. This assessment will aid in setting protective measures.

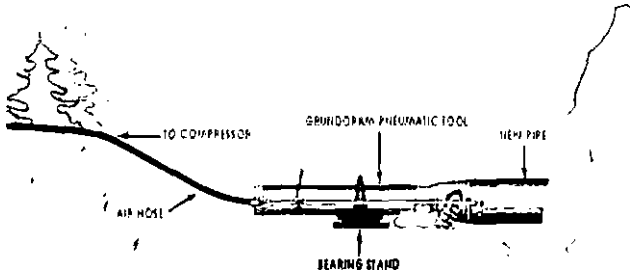
GENERAL TRENCHLESS CROSSING METHODOLOGY

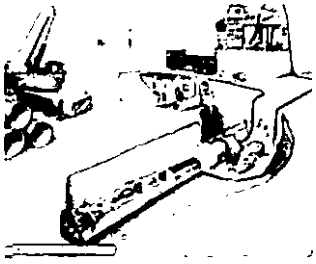
Depending on the trenchless crossing conditions, three "tunneling" methods may be appropriate: Auger Boring, Pipe Ramming, and Microtunneling. Each of these methods are appropriate for different types of subsurface conditions. The Auger Boring and Pipe Ramming are similar methods and require similar design efforts and construction space. A general description of each of these processes is provided below.



Auger Boring | Auger Boring, also referred to as Horizontal Earth Boring, is generally considered the process of simultaneously jacking a steel casing through the ground while excavating and removing the soil from the inside the casing by means of a rotating, continuous flight auger. Utility crossings completed by this method must be straight and level, or very slightly sloped. Auger bore applications are generally limited to drive lengths less than 200 feet. However, drive lengths up to 500 to 600 feet are feasible under certain conditions. In a typical application, the product utility is installed inside the casing. Typically, auger boring is done with pipes 18 to 48 inches in diameter and larger.

Pipe Ramming | Pneumatic ramming tools are used for the trenchless installation of steel pipe through a wide variety of soil types. Some casing installation methods are impaired or even rendered inoperable by rock or boulder filled soils. Pipe ramming may be used for horizontal, vertical, and angled installation of steel pipes or casings. The pneumatic ramming tool is attached to the back of steel pipes or casings and hammers them into the ground. Pipe can be driven as one continuous run or in sections depending on the space available at the insertion site. Spoil is removed by using compressed air and/or water, or augers. The pipe diameter range for microtunneling is generally from 12 to 60 inches with reaches of up to 300 feet.





Microtunneling | Simply stated, microtunneling is a pipe jacking process that employs a remotely controlled, closed face tunneling shield, also commonly referred to as a Microtunnel Boring Machine (MTBM). Closed face shields are capable of exerting a positive pressure at the excavation face in order to maintain stability of the face and prevent ground and groundwater inflow. Routine personnel entry of the pipe being jacked is not required for microtunneling. The majority of MTBMs in the United States today are of the slurry type. The pipe diameter range for microtunneling is generally 10 to 136 inches. The most common pipe diameter range for microtunneling is between 24 and 72 inches.

DESIGN PHASE QA/QC – TO BE COMPLETED AT 30%, 60%, 90% AND 100% SUBMITTAL

Once a preferred alignment has been selected and materials of construction designated, the Michael Baker team will provide internal quality control checks at each major design submittal on the following specific items:

- Profile optimization – review of minimum depth to avoid utility conflicts and reduction of vertical bends
- Valve spacing for isolation
- Material selection design limitation for allowable joint deflection and restraint, and required separation for fittings
- Transient pressure analysis and thrust design
- Congruence with soil types from geotechnical reports, corrosivity reports, and cathodic protection
- Construction sequencing for continuous water service

In addition to these items, the following standard water main design items will have a complete QA/QC review:

- Identify glaring deviations from the CAD Standard
- Identify design inconsistencies between plans and profiles
- Identify glaring constructability issues and confusing drawing notations and labels
- Identify clashes between proposed work and existing utilities and structures
- Determine if the appropriate replacement construction methodology is appropriate
- Verify pipe restraint calculations and lengths
- Check water service line information against as-built records
- Perform field walk and compare engineering design to observable features, such as trees, utility markings, utility poles and pedestals, etc.
  - Check material take-offs for completeness and cross-check with cost estimate and bid forms
  - Check structure calculations
  - Check thrust blocks and thrust collar calculations
  - Check pipe loading and floatation calculations
  - Check traffic control plans
  - Check stream restoration designs
  - Check landscape designs
  - Check hydraulic calculations, including, but not limited to, surge analysis, pump curves, etc.
  - Determine if the appropriate special provisions, special conditions, solicitation forms, attachments, and appendices are included

D. EVALUATION OF PIPE MATERIAL AND PRESSURE CLASS

The Michael Baker team will evaluate pipe material options for construction of the redundant rising main and provide the PWSA recommendations based upon cost, site conditions, performance requirements, and feasibility of construction. The majority of the proposed Lanpher Rising Main is anticipated to be constructed using open-trench installation methods. However, trenchless installation methods such as jack and bore, pipe ramming or microtunneling, will be evaluated for specific portions of the alignment. Various pipe materials and corresponding pressure classes will be evaluated, based on external loading (including depth of cover) over the pipe, internal operating pressure, test pressure, intermittent transient (surge) pressures, and vacuum (particularly for steel pipe); which will determine the recommended wall thickness. Pipe materials to be evaluated may include ductile iron pipe (DIP), pre-stressed concrete cylinder pipe (PCCP), and welded steel pipe (WSP), if desired. DIP, PCCP and WSP are subject to corrosion, depending on the surrounding soil conditions, depth of the groundwater table, and proximity to overhead power transmission line and/or other impressed current cathodic protection systems. These conditions will require installation of a corrosion protection system that may include joint bonding, installation of electrical isolation flanges, permanent reference electrodes, and test stations. The pipe recommendations will include the pressure rating of the pipe suitable

to the anticipated external loads and internal pressure. A workshop will be held with the PWSA to determine final pipe selection for the design.

The Michael Baker team will work with the PWSA to obtain the latest version of their hydraulic model (PWSA WaterGEMS® Model Network), with priority given to the extent of the model starting at the Aspinwall Pump Station (PS), continuing along the existing Lanpher Rising Main and terminating at the Lanpher Reservoir. We will use this as the base model to build a hydraulic and transient analysis model of the two proposed Lanpher Rising Main alignments to evaluate and make a recommendation based on the hydraulic conditions. The existing hydraulic model will be used to obtain information on the existing Lanpher Rising Main, including:

- Pipe diameters
- C-Factors
- Lengths
- Fixture elevations
- Appurtenances locations
- Main alignment
- Demand and configuration data for the eight (8) active service connection

Additionally, we will pull data on the pump, head, and flow conditions at the Aspinwall PS, as seen during average daily operating conditions. To account for all pumping conditions potentially experienced at the Aspinwall PS, the team will coordinate with the PWSA operations staff to collect and verify pump data for all pumps at the Aspinwall PS. We will calibrate the model to simulate all potential pumping scenarios using detailed pump information, including:

- Pump curves
- Average/maximum number of pumps simultaneously running
- Sequencing of the pumps
- Average daily and peak hourly pump rates
- Maximum pump station capacity
- All available supporting SCADA or chart recorder data

HYDRAULIC MODELING

The Michael Baker team will build a new hydraulic model in Bentley software WaterGEMS® using the base model pulled from the PWSA's hydraulic model and Aspinwall PS data provided by the PWSA. This new model will consist of the Aspinwall PS, the existing Lanpher Rising Main, all existing Lanpher Main service connections, the Lanpher Reservoir and the two alternative Redundant Rising Main alignments. The team will model each alignment alternative separately under each of the specified Aspinwall pumping conditions, and both with and without the existing service connections active on the Rising Main. We will include an additional scenario with the service connections active to ensure the required chlorine contact time can be achieved while using the redundant main to feed the Lanpher Reservoir during the clearwell replacement. The team will separately model each of the alternative alignments under nine scenarios for each alignment, for a total of 18 scenarios. A breakdown of the scenarios to be run for each alignment.



Proposed alignments and preliminary valve spacing for Lanpher Redundant Rising Main

The Michael Baker team will review and compare the results of all the scenarios for both alignments focusing on the modeled worst-case conditions. Included in the results analysis will be detailed review of the results for any lapses in the desired level of service including:

- System delivery pressure
- Fire flow capacity
- Pipe velocity
- Head conditions at the Aspinwall PS

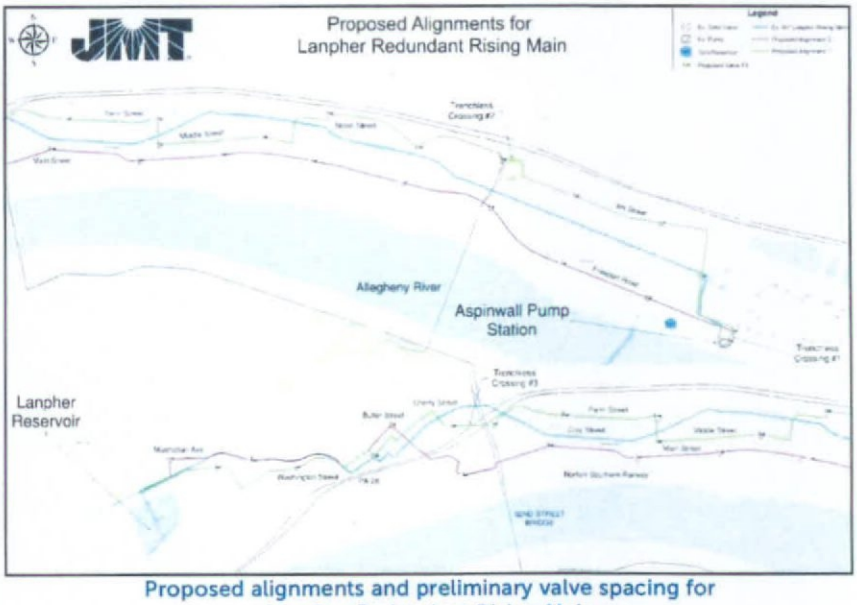
MODELING SCENARIOS FOR BOTH ALIGNMENT ALTERNATIVES		
Pump Rate	**Connections Demands**	**Scenario**
Average Daily Flow	Off	Scenario 1
	On	Scenario 2
	On - With Contact Time	Scenario 3
Peak Hourly Flow	Off	Scenario 4
	On	Scenario 5
	On - With Contact Time	Scenario 6
Maximum Pump Station Capacity	Off	Scenario 7
	On	Scenario 8
	On - With Contact Time	Scenario 9

After close review of the model results under all scenarios, we will make a recommendation based on the number of hydraulic limitations and estimated cost/feasibility of addressing these limitations based on the results of the hydraulic modeling. Included in the recommendation will be a comparison of the two alignments detailing the amount and severity of any hydraulic restrictions experienced under each alternative, highlighting any condition or hydraulic restriction that will generate an unacceptable lapse in the required level of service.

Transient Analysis | The Michael Baker team will use the hydraulic model for the recommended alignment alternative to build a transient analysis model in Bentley software HAMMER®, which is compatible with WaterGEMS®. JMT will use the transient model to review the upsurge and downsurge events anticipated in the new alignment, given the assumed vertical profile and pipe material. JMT will model several pressure transient inducing events on the recommended alignment without any surge mitigating devices, including the following scenarios:

- Pump failure for Aspinwall pumps
- Power loss at Aspinwall PS
- Sudden unintended valve closure
- Pipe rupture

After modeling the initial transient scenarios, we will review the results of transient analysis and make recommendations on the size, number, and location of air release, air vacuum, and pressure release valves necessary to mitigate resulting pressure transients. We will rerun the transient analysis to include the proposed transient surge mitigating devices until the transient analysis shows an acceptable magnitude of surge pressures under all the modeled scenarios. **Once the potential for transients has been mitigated, the team will make recommendations on the pipe material necessary to withstand the highest anticipated surge pressure, make recommendations on best practices for pump operation at the Aspinwall PS, and recommend any thrust restraint required due to the resulting mitigated transient forces.** We will include graphical results of the transient analysis under the unmitigated and mitigated conditions for all the transient analysis scenarios. Proposed valve spacing is depicted in the graphic.



Proposed alignments and preliminary valve spacing for Lanpher Redundant Rising Main

Hydraulic & Transient Modeling Report | The Michael Baker team will compile the results of the hydraulic and transient analysis modeling in a Modeling Design and Recommendations Report. This report will detail the model construction, hydraulic scenarios, model results, and recommendations for both aspects of the model. The hydraulic modeling section will provide graphical and numerical results for both proposed alignments for the Lanpher Redundant Main, including:

- Pressure conditions
- Hydrant capacity
- Pump head and rates
- Alignment recommendation

The transient modeling section will also provide graphical and number results for the alignment recommended in the Hydraulic Modeling section for both the unmitigated and mitigated version of the alignment, including:

- Unmitigated pressure transients under the worst-case transient simulation

- Recommendations on the number, size, and placement of necessary valves
- Pipe material recommendations;
- Aspinwall pump operation recommendations
- Required thrust restraint
- Results of transient analysis after inclusion of the recommended valves

At the end of the hydraulic and transient analysis modeling, The Michael Baker team will provide the PWSA a copy of both the hydraulic and transient analysis model.

E. PIPELINE PLANS AND DETAILS

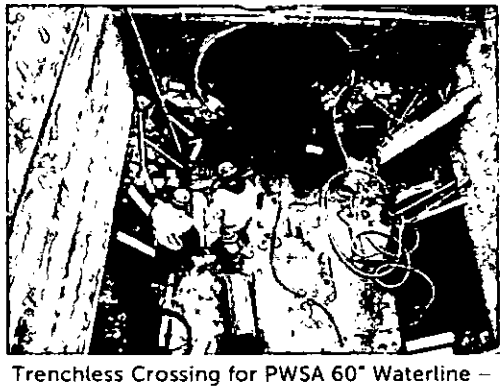
DIFFERENTIATOR

PREVIOUS EXPERIENCE WITH THE PWSA 60" WATERLINE

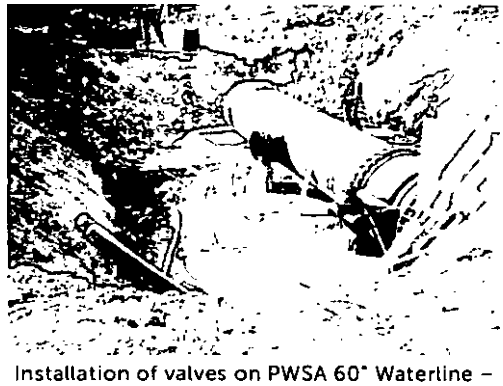
The Michael Baker team has recent project experience designing a relocation of a section of the PWSA 60-inch waterline in a nearby project area along State Route 28 and on the same reservoir system as the 60-inch waterline in this project. Design of a large diameter waterline presents challenges that design of conventional smaller diameter distribution facilities typically does not. The cross-sectional area of the pipe trench required to accommodate the 60-inch waterline presents daunting challenges in that every existing utility or structure that falls directly within or is affected by the influence zone of the trench must be considered as part of the design. Pipe fittings, valves, and other appurtenances similarly require footprints that are 2 to 3 times the actual diameter of the waterline and can require significant rights-of-way or easements to accommodate.

Michael Baker will utilize the information and details created during the S.R. 28 Project.

The project also incorporated unique trenchless installation methodology where the proposed 60-inch waterline had to cross the existing active 60-inch waterline which remained in service during construction of the new pipeline. The technique utilized excavation with a mini skid steer machine and lining of the excavated hole with liner plate. Tight site constraints and subsurface obstruction concerns made conventional boring and jacking infeasible and the shorter length of the crossing did not make microtunneling a cost-effective option.

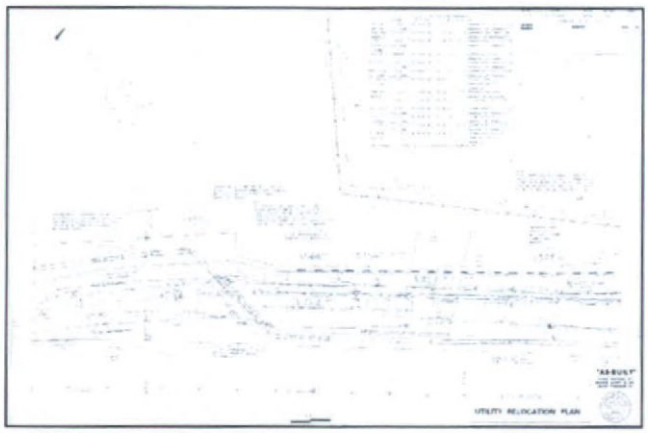


Trenchless Crossing for PWSA 60" Waterline – SR 28 Millvale



Installation of valves on PWSA 60" Waterline – SR 28 Millvale

Design of the 60" waterline was performed in conjunction with vendor technical coordination. Unlike smaller diameter waterlines, where a multitude of valves, fittings and appurtenances are readily available "off the shelf", components for waterlines 36" and larger tend to be made in response to vendor orders. Long lead times are the norm, and the design must be thoroughly reviewed to ensure that the components are available to fit the installation. Often, factory made specialty fittings can be provided to save on fitting costs and minimize joints. Connections to the existing riveted steel pipe required field fabrication by a welding company experienced in making large diameter custom transition couplings. Consideration for joint types on straight pipe, fittings and valves must be made in conjunction with thrust restraint calculations. For an installation of this type, a "lay schedule" is specified, in which the contractor is required to submit a vendor generated shop drawing that essentially identifies each individual pipe segment and fitting and provides a numbered installation sequence.



PWSA 60" waterline relocation on S.R.28 East Ohio Street

The plans will be developed beyond the concept design phase to a staged development of Preliminary Design (30 %), 60 %, 90 %, and final design plans. It is within this stage that we can work to develop a comprehensive phasing plan that will allow the PWSA to offer up multiple construction contracts to execute the work. Understanding that "time is of the essence" for this project, we not only are seeking to reduce the design phase efforts but also find creative ways to reduce the construction time for the project. When we review the extent of the project, the construction value is significantly higher than traditional water conveyance projects let by the PWSA, and in fact we believe would potentially reduce the pool of qualified bidders due to the high bonding capacity required for the contract. Additionally, the effort required for a single contractor to execute the entire project expediently would require substantially larger constructors that would likely come from outside of Pittsburgh. We think that breaking the construction effort into multiple sections that can be let individually or as a combined bid will allow the PWSA to engage multiple contractors within the Pittsburgh market to expand the pool of potential bidders and drive more competitive pricing. The use of multiple contractors will allow concurrent construction of multiple sections of the overall system which can reduce the time of construction dramatically. If the construction effort is essentially the same in either instance, this approach delivers a reduced construction window, creating substantially lower general conditions costs for the contracts. Furthermore, the multiple construction sections would allow the PWSA to provide greater economic impact to Pittsburgh-based contractors that work on a reduced scale and opens the door to small and minority-owned contractors to pursue smaller sections of this project. In fact, the section limits can be set strategically to create these opportunities.

PLAN DEVELOPMENT

- The project base mapping will be a combination from several sources. The mapping will begin with a compilation of data collected during the initial phases of the project. Michael Baker will identify all potential sources of data, particularly CADD or GIS based, and request permission from the respective owner to utilize it for the project. Allegheny County contour and planimetric mapping files will be utilized for the site base mapping. CADD, GIS, or raster files of municipal sewers will be referenced to the base mapping. However, the specific alignment to be followed will be completely surveyed using the combination of mobile LiDAR and traditional total station survey combined with SUE Level A determination of existing utilities within the corridor. This approach to base mapping provides a sufficient level of detail outside the excavation zone while expanding the level of detail where needed to ensure the new rising main with alignment conditions and constraints are known.
- The plan drawings for 30 %, 60 %, 90 %, and final design will be prepared in accordance with the CADD standards as set forth by the PWSA to establish construction bid documents. Trained CADD technicians and design engineers will prepare AutoCAD Civil 3D files. The integrated civil design software within Civil 3D will be utilized to automate many aspects of the drawing preparation, including terrain modeling; plan/profile preparation; and point cloud reduction. The construction plans will include title sheet, index map, quantities and general notes, geometric layout and project coordinates, construction detail sheets, and MPT Plans.
- The public infrastructure will include project, plan sheets, profiles sheets, cross sections, supplemental drawings, including MPT plans, pavement restoration plans, utility plans, erosion and sediment control plans, trenching plans, and details.
- The MPT plans will be prepared in accordance with the PennDOT Traffic Control Plan standards to obtain necessary traffic obstruction permits from the various municipalities that the rising main alignment will pass through. This approach allows the use of a common basis for the plans that should meet or exceed the local standards and accounts for traffic control on any PennDOT roads that the project would utilize. The plan will depict various traffic control devices, including temporary signage, barriers, sequencing, detours, etc. The MPT plan will be submitted to the county and local municipalities for review and approval to obtain all necessary permits, including the Traffic Obstruction permit. Following submission of the application, the Michael Baker team will address comments from the municipalities and obtain approval during the Construction Plans phase of the project.
- The area in which the proposed rising main alignments will travel is a densely populated area with narrow rights-of-way, dense urban development, and significant legacy infrastructure both above and below ground. Therefore, the infrastructure construction requires

sequencing to maintain a delicate balance of safety, construction, access to residences and businesses, and traffic movement. The Michael Baker team will create proposed construction phasing plans and associated traffic control to minimize the length of time that any one group is affected by the construction. As noted above, a significant reduction in overall construction duration can be realized by breaking the overall project into discrete sections to be concurrently constructed. The sequencing of each of these sections will not only be coordinated internal to the section but external to the other sections to provide a comprehensive plan that would recognize impacts not only to the immediate vicinity of construction but the larger transportation network.

Specification Development

- The Michael Baker team will prepare an outline list of anticipated front end (Division 0) Contract Forms, Conditions of the Contract, the Prevailing Wage Determination Schedule(s)) and technical specifications based upon the intermediate design level. It is our understanding that the PWSA will provide the Division 0 and 1 sections for final editing for this project by the Michael Baker team. The Michael Baker team will assist the PWSA in developing the bid advertisement and assembling a complete package of bid documents for prospective bidders. The participation of minority group enterprises will be encouraged to afford equal opportunity to minority businesses in the construction of the project. Again, the development of multiple construction packages can be used to facilitate the creation of a section or sections that are tailored to be of appropriate construction value to facilitate small and minority business participation in the construction phase. It is anticipated that the PWSA will provide copies of the plans and bid documents for the prospective bidders.
- The Project Manual will be completed using CSI's 2004 format specifications in MS Word. The specifications will be created and modified according to the project scope and modifications using track changes.
- The Michael Baker team will prepare additional specification sections not currently covered by the PWSA guideline specifications in CSI 2004 Master Format. The Michael Baker team will modify reconstruction specifications according to the latest version of the Department of Public Works Right-of-Way Procedures Manual and will prepare special provisions for all contract items that are not governed by the PWSA.
- The Michael Baker team will utilize the unit items in the final estimate based on the Master Bid Item List, to the extent possible. The team will seek the PWSA's approval prior to adding any new bid items or making changes to existing Item descriptions.
    - Opinion of Probable Construction Costs: The Michael Baker team will prepare a detailed Preliminary Opinion of Probable Construction Costs at the intermediate plans and to the AACE Cost Estimate Level. The unit costs will be based upon the PWSA bid tabulations and the Michael Baker team's experience with similar projects and reference material available at the time. The Michael Baker team will list all the assumptions which are used in deriving the unit cost and total engineer's cost estimates. It is important to note the unique nature of the 48-inch water main construction with respect to accurate estimates of cost. The Michael Baker team will use our recent experience in the construction of 48-inch water mains to help develop the most accurate cost profile possible.
    - The Michael Baker team will perform Value Engineering, peer review and prepare Technical Reports and Constructability Reviews for submission to the PWSA for review and comment. The Michael Baker team will prepare a comment response report in a Comment Resolution Memorandum, which will be returned to the PWSA for consideration.

Final Design Phases

The Michael Baker team will prepare the plan drawings for 30% preliminary design, 60%, 90%, and final design in accordance with the CADD standards as set forth by the PWSA to establish construction bid documents. It is anticipated that the design documents will require submission to the various cities and boroughs, City of Pittsburgh DPW/DOMI, Allegheny County Conservation District, PennDOT, PADEP, and all other appropriate corresponding agencies for review at the 60%, 90%, and final design phases.

30% DESIGN PHASE

Final Design - Geotechnical Services - 30% Design | The Michael Baker team will evaluate the completed geotechnical report findings from the Preliminary Design and develop recommendations to support the design and construction of the proposed infrastructure. The objective of the subsurface investigation program will be to collect the geotechnical data necessary to ensure that key design parameters

and subsurface risks can be identified. To develop an effective and efficient subsurface exploration program, it is beneficial to understand as much as possible about the subsurface ground conditions. Before this Phase, the Michael Baker team will have executed a complete core boring program with full time drill inspection and field instrumentation installation. In addition, the Michael Baker team will have the results of the laboratory testing from an AMRL-approved testing laboratory. This will allow the geotechnical engineers to determine the soil characteristics, stratification of the geology, and depths to groundwater table and bedrock, where encountered. Given the history of geologic processes in the area and documented landslides there are several critical factors that will need to be considered in the siting of the rising main route from a geologic standpoint.

Final Design – Rising Main Design –30%, 60%, 90%, and Final | The rising main construction plans will include plan and profile views of the proposed 48-inch waterline, cross sections of the roadway excavations to accurately documents that trenching limits with respect to adjacent improvements, typical cross sections for restoration work, waterline appurtenance details, erosion and sedimentation control details, and a summary of quantities. Also included will be details for geotechnical engineering techniques, specific slope and trench treatments, phasing plans, and site access plans. Documented engineering design criteria and calculations will be used to size the various components. General Deliverables for the 30% submittal:

- Each milestone submission will address any review comments from the previous submission. The Michael Baker team will prepare a comment response letter and document in the Design Comment Review Log provided by the PWSA.
- All the Revised drawings to be submitted to various permitting agencies will include a cover/title sheet, general notes and index sheet, plan sheets, profiles sheets, cross sections of roadway and above ground and underground utility features, supplemental drawings including MPT plans, utility plans, erosion and sediment control plans, and trenching plans and details. The Michael Baker team will prepare a preliminary Roadway Paving and Restoration Plan for anticipated construction activities. This plan will include areas of full and partial depth roadway restoration affected by the installation of the new piping, curbing, painting and striping in accordance with the roadway owner's standards. This plan will be closely coordinated with the respective Highway Occupancy Permit submissions described in this proposal.
- The Michael Baker team will submit the revised sections of all technical specifications based on comments from the previous submission
- The Michael Baker team will provide updated engineer's probable construction cost estimate and appropriate analyses/calculations for review and comment for the PWSA
- The Michael Baker team will prepare all necessary Right-of-way and/or construction and permanent easement exhibits.
- The Michael Baker team will develop a Hydraulic Analysis Report that includes supporting documentation and calculations for the sizing and routing of the 48-inch rising main. It is anticipated that The Michael Baker team will utilize the existing input information from the preliminary WaterGEMS® and Hammer models to be provided by the PWSA. The report will include all the following supporting calculations and discuss important project issues and assumptions:
  - The Michael Baker team will list all deviations from the Preliminary Design Memorandum based on the review of the preliminary report by Mott MacDonald, as well as proposed design improvements.
  - The general components of the Hydraulic Analysis Report will include the following:
    - Narrative/Objectives: Discussion of the objectives of the hydraulic analysis.
    - Scenario Development: Outline of various scenarios and hydraulic criteria to be modeled and analyzed for the determination of the proper pipe sizing and routing to meet the needs of the PWSA.
    - Calculations: Presentation of the hydraulic calculations for each scenario.
    - Conclusions: Summary presentation of the results of the analysis of the hydraulic models along with the recommendations of the Michael Baker team.

The Michael Baker team will prepare a construction CPM schedule for the construction activities associated with the proposed improvements. The CPM schedule will address the work activities required for all phases of construction and the multiple sections of concurrent construction activity. This will include work activities to construct the proposed improvements according to the construction sequence of the Traffic Control Plan and E&S Plan. Also included will be special coordination issues. Construction phasing will be used to determine intermediate milestones and the construction completion date. Upon completion of the CPM schedule, a review meeting with the PWSA is anticipated to resolve any

questions or scheduling issues which may arise, to arrive at an acceptable project duration. The Michael Baker team will make any necessary revisions and submit the CPM schedule with the 100% submission.

60% DESIGN PHASE

Final Waterline Design and Geotechnical Services - 60% Design | The Michael Baker team will evaluate the completed geotechnical report findings and develop recommendations to support the design and construction of the proposed infrastructure. The task will include the review of the final plans to assure geotechnical recommendations are implemented and are included in the submission. Any geotechnical comments on the 30% design submission will also be addressed in the submission. General Deliverables for the 60% submittal:

- During 60% design phase, The Michael Baker team will review and address comments from the previous 30% submission and submit all revised deliverables for review to the PWSA (i.e. updated cover sheet, general notes, index sheet, plans, profiles, typical sections, cross-sections, right-of-way plans, landscape plans, restoration plans, technical specifications, and construction cost estimate, drainage analyses and stormwater management reports, exhibits, E & S plans, MPT plans and construction schedule
- The Michael Baker team will prepare a comment response letter for 60% submission phase and document in the Design Comment Review Log provided by the PWSA.

90% DESIGN PHASE

Final Waterline Design and Geotechnical Services - 90% Design | The Michael Baker team will provide a final geotechnical review and support for the final plans, specifications and cost estimate. The task will include the review of the final plans to assure geotechnical recommendations are implemented and are included in the submission. Any geotechnical comments on the 60% design submission will also be addressed in the submission. General Deliverables for the 90% submittal:

- During 90% design phase, The Michael Baker team will review and address comments from the previous 60% submission and submit all revised deliverables for review to the PWSA (i.e. updated cover sheet, general notes, index sheet, plans, profiles, typical sections, cross-sections, right-of-way plans, landscape plans, restoration plans, technical specifications, and construction cost estimate, drainage analyses and stormwater management reports, exhibits, E & S plans, MPT plans and construction schedule
- The Michael Baker team will prepare a comment response letter for 90% submission phase and document in the Design Comment Review Log provided by the PWSA.

100% DESIGN/BID READY PHASE

Final Waterline Design and Geotechnical Services – Final Bid Design Phase | The Michael Baker team will provide geotechnical review of Final design calculations, Final Design Memorandum, construction schedule, sequence of construction, cost estimate and bid sheets. General Deliverables - The final design deliverables for the 100% submission to the PWSA include the following:

- Revised drawings with incorporated comments from 90% submission
- Final original Mylar, signed and sealed drawings and technical specifications, which will be used to distribute to bidders for the construction solicitation
- Construction drawings will be sealed by a licensed Professional Engineer in the Commonwealth of Pennsylvania
- Final Technical Specifications
- Final design calculations, reports, sketches
- Receipt of permits to construct and other agency/utility approvals
- Engineer's Estimate of Construction Cost
- Projected construction schedule
- One copy of design calculations and sketches
- One copy of final bid forms
- Electronic copy of all plans and technical specifications
- Prevailing wage rate sheets specific for the project type and time of bidding

F. MEETINGS

Throughout the duration of the project the project team will be required to meet with the PWSA to provide valuable coordination and feedback. Additionally, there will be a minimum required set of meetings at various project milestones that will require the team to represent the project along with the PWSA. At the onset of the project Michael Baker will attend a project kick-off meeting to introduce the project team and to cover the expectations and schedule for the project. The kick-off meeting will help to establish an open communication flow between the PWSA and Michael Baker's team for the project. Beyond the initial kick-off, the team will meet monthly to review the project status and progress and provide an opportunity for the team to work collaboratively on resolving any issues or challenges that may arise. However, it is important to note that Michael Baker will not wait for a monthly meeting to address items that require more immediate attention. If a meeting is warranted to facilitate the resolution of a project challenge, we will request a meeting with the appropriate PWSA team members and any outside stakeholders to address it as quickly as possible.

Along with the progress meetings, there will be several required meetings that occur at project milestones. These are primarily the design review meetings. We will meet with the appropriate team members at the end of the Preliminary Design period (30%), 60%, 90%, and 100%/Bid Ready review milestones at the PWSA's offices. In addition to these meetings, we have planned for attendance at the pre-bid and pre-construction meetings. Michael Baker will make sure that the team members present at each of the design review meetings can discuss the various aspects of the design in detail to facilitate the meaningful discussion of review comments that lead to resolution and a clear path forward. This approach allows the subject matter experts to guide the process with the PWSA and will reduce the time it takes to resolve comments to the plans.

Finally, Michael Baker will attend meetings with PADEP, impacted utility companies, local municipalities, stakeholders, and other public and private entities that will be involved in the review and permitting process for the redundant Lanpher Rising Main alignment selection and construction plan development. We anticipate one public workshop to review the plan with all stakeholders. Additionally, we plan to work closely with the utility companies and local municipalities to provide timely information regarding the design intent and details for how the project will impact their facilities. We will develop a series of utility coordination meetings as well as project coordination meetings with the various involved agencies, to bring together the larger group so common issues can be discussed and resolved quickly and efficiently with buy-in from all parties.

G. TRAFFIC CONTROL PLANS

While determining a feasible and prudent route for the water main will be challenging, the actual construction will present the greatest challenge. Minimizing impact on vehicular and non-vehicular mobility and access will be paramount to ensure successful construction. Many of the roadways in Aspinwall, Sharpsburg, Etna, and Shaler are relatively narrow and may not have sufficient width to maintain vehicular traffic during construction. Furthermore, many of these roadways are one-way and provide the only access to individual homes and businesses. The impacts on any individual property will need to be closely considered while determining how to construct the water main. Beyond individual properties, UPMC St. Margaret's Emergency Room and other critical facilities must always remain accessible.

Traffic Engineers will be involved in the route evaluation to ensure that no construction-related traffic impacts become fatal flaws. Because of the size and depth of the water main, many of the roadways will need to be closed and detoured to allow for construction. During working hours, the approach will be to use the grid network of streets to detour vehicular traffic one block at a time. Sidewalks and access to homes, businesses, and public transportation will need to be maintained. The use of protective fence or temporary barriers may be required if construction activities cannot avoid encroaching onto sidewalks or other pedestrian routes. Overall, the goal will be to minimize disruption for neighborhood residents and businesses while still allowing for the most efficient construction.



Port Authority bus routes in project area along Freeport Road

Minimizing disruption will also entail coordinating work with other projects in the vicinity. As Michael Baker is currently designing the traffic control for the Highland Park Interchange Improvement Project, we have a thorough understanding of when Highland Park Interchange traffic will be directed to Freeport Road or Delafield Avenue. Avoiding work on these routes during those elevated traffic conditions will be critical to ensure continued mobility through the area.

H. PERMITTING

During the evaluation of the preliminary design and design alternatives task (Task 1), the Michael Baker team will evaluate the permits that will be required based on the layout of the design and experience with similar projects and discussions with the regulators. It has been our experience that the permitting process can become the single step that holds up a project's construction; therefore, it is imperative for a project of this size to begin working closely with the regulators early in the design process. Michael Baker anticipates the following items will be prepared/obtained to support the permitting effort for the project:

- Act 14 letters.
- The Cultural Resource Notice (CRN) Form (Section 106 Pennsylvania Historical & Archaeological Resource Protection – PA Historical & Museum Commission – Bureau of Historic Preservation) - The Michael Baker team will review the Cultural Resources Geographic Information System (CRGIS), historical photographs, and other available data to identify any potential PHMC concerns. A letter report will be prepared for consultation with PHMC. A Phase I Archeological Investigation beyond review of CRGIS is not included in this scope of work.
- PNDI Search Results and Clearances (Threatened and Endangered Species Clearances) - The Michael Baker team will perform the Pennsylvania Natural Heritage Program (PNHP) PNDI online search for this project. Based on these results, the Michael Baker team will provide additional coordination with the appropriate agencies as necessary. This coordination will include a project narrative, site location map, and a project plan drawing as part of this task. Additional studies or assessments are not included in this scope of work.
- Project construction plans.
- An 8.5" x 11" copy of the 7.5-minute quadrangle depicting the project location.
- A detailed Project Description Narrative describing the purpose of the project and its associated impacts to the surrounding environment.
- Representative photographs of the proposed site and a photo index map indicating the location and direction of each photograph will be included.
- Completion of the Environmental Assessment form and associated documentation for the Rapid 2 Assessment Protocols. Wetland & Stream Field Work included in this scope of work is a site visit for Michael Baker's Environmental Specialists to delineate existing site wetlands/streams. Streams/wetlands discovered in the study area will be mapped and incorporated into the project's base mapping. The results of the environmental survey will be documented in an Aquatic Resource (wetland and stream) Delineation report. The report will consist of photographs, figures, and ACOE data sheets. GIS delineation and location data collected in the field will also be provided.

PERMIT SUMMARY TABLE
PennDOT
Highway Occupancy and Joint Permits
City of Pittsburgh/Municipal Permits
Roadway Operating Permit
Traffic Obstruction Permit
Street Opening Permit
Land Operations Permit
Demolition Permit
Encroachment Permit
Stormwater Plan
Tree Permit
Construction and/or Development in the Floodplain
Water Obstruction and Encroachment
DEP Joint Permit Application/US Army Corps of Engineers Section 404
General Permits
Transfer of Permit and Submerged Lands License
National Pollutant Discharge Elimination System (NPDES)
General Permit
Individual Permit
Stormwater Construction Activities
Erosion and Sediment Control
Rare Threatened and Endangered Species
Pennsylvania Natural Heritage Program – Pennsylvania Natural Diversity Inventory
Other Related Resources
Pennsylvania Historical & Archaeological Resource Protection – PA Historical & Museum Commission – Bureau of Historic Preservation
Other Program Potential Requirements
Pennsylvania Storm Water Management Act (Act 167)
Water Quality Management Permit
Water Quality Management General Permit for Small Flow Treatment Facilities
General Permit for Sewer Extensions and Pump Stations
Water Quality Management Post Construction Certification
Water Allocation
Safe Drinking Water
Act 537 – Municipal Sewage
Pennsylvania Act 2 Land Recycling Program – Voluntary Cleanup Program
Brownfield Redevelopment Program

- Michael Baker does not anticipate any stream or wetland mitigation since this project will use trenchless installations at the stream crossings.
- Erosion & Sediment Pollution Control Plan Approval letter (Chapter 102)
- Stormwater and Floodplain Management consistency letters (as needed)
- Risk Assessment

Michael Baker understands that the permitting effort is critical to the project design timeline. With the full understanding that "time is of the essence," we will work to shorten the design phase timeline where possible. We have done our best to identify the anticipated permits within the list above, but also understand that with such a diverse range of permitting entities, there is the opportunity for unforeseen items to be required. **We will work proactively with each agency at the onset of the project** to develop a plan for permitting efforts to determine the permits that will be required, the requirements for each submission, and the anticipated review timeline. We will review the design approach with the agencies prior to submission to get initial feedback on the design approach to avoid significant comments and changes during the permit process. In keeping with this approach, we will conduct an initial permitting kick-off meeting with all agencies involved in the permitting process invited to attend. This meeting will focus on the initial presentation of the planned project and potential areas that will involve the various permits identified. We have found that in the past, this approach allows the various agencies to interact with the design team, each other, and the owner to facilitate a more comprehensive understanding of what each agency will be responsible for and the anticipated timelines for each piece. This also allows the owner to document feedback in the form of meeting minutes, so that there is a record of any issues notes, timelines set, and agreements made as part of the initial discussion. With this approach, we hope to reduce the permit timeline and push the project toward construction.

Working hand in hand with the permit process is the coordination with the various stakeholders and involved agencies. The coordination of with each of these above and beyond the permit process is essential to project success. The key coordination items are as follows:

I. EASEMENTS

The projected route for the new rising main will require the installation of the line within various properties and rights-of-way that have a diverse ownership and jurisdictional control.

The Michael Baker team understands the needed methodology for project delivery. Beginning with a thorough and detailed review and understanding of the overall project, ROW plans, and all available materials, the existing rights-of-way and parcel boundaries will be delineated. Upon completion of the initial review, Monaloh will work with the Michael Baker team by identifying all required easements, whether temporary or permanent, and assisting in the preparation of all documents and negotiation and acquisition of all easements. Monaloh will assign parcels and tasks to maintain a strict delivery schedule and will update the Michael Baker team and PWSA personnel using email, tracking spreadsheets, and right-of-way office. Monaloh recognizes that Quality Control is paramount to successful project delivery.

As a prime right-of-way consultant on large-scale rights-of-way projects, the Michael Baker team is intimately familiar with the state, and local requirements, laws, policies, and procedures for negotiations, right-of-way acquisition, and title. We recognize the importance of working within the clients' established guidelines and procedures to achieve timely project delivery.

We will aid the survey team in the proper identification of parcel ownership and owner communications and supporting documentation. We will coordinate with the PWSA legal on all easements and other needed documents. Monaloh may accompany field teams for landowner consults and with special conditions relating to landowner property.

PRELIMINARY DESIGN PHASE

The right-of-way services will begin with the preliminary design phase. The initial work will include the background records and deed research to establish the property ownership, right-of-way limits, and any easements and encumbrances recorded within the project vicinity. The research will be purposefully broad in its approach to provide adequate coverage for potential shifts in the project alignments. The team will create a comprehensive report of findings that will be integrated into the initial survey plans for the project.

During the evaluation of possible alignments, Monaloh will provide input on the possible easement concerns or requirements for the execution of each possible alignment. The input will highlight the amounts of private parcels and property takes required, as well as impacts and overlap with existing easements that may require coordination and agreement to be created for having overlapping easements and facilities. The right-of-way input will be factored into the evaluation of each alternate along with other considerations to assist in the derivation of a preferred alignment.

30% DESIGN PHASE

Our clients understand that with early involvement of our team, we can help to avoid costly routing problems. With our due diligence processes, Monaloh will identify parcel ownership that may negatively impact the route or create dramatic changes in negotiation timelines leading to construction delays. Once the preliminary alignment is set, Monaloh will establish the required easements, both temporary and permanent, the number of property takes required, public rights-of-way impacted, and any conflicting easements or encumbrances based upon the preferred alignment. The real estate impacts will be summarized and presented within the Design Memorandum and projected costs added to the conceptual opinion of probable construction costs.

Deliverables for this phase of work will be:

- Summary of findings
- Full back-up of all records research, including deeds, right-of-way plans, plat maps, legal descriptions, and record documents
- Preliminary right-of-way plan for the rising main alignment

60% DESIGN PHASE

The next phase of development will be the 60% design development. During this phase the real estate services will focus on the creation of legal descriptions and figures for the various easements, rights-of-way, and final determination of property takes to facilitate the implementation of the approved rising main alignment. Alignment review discussions with our project manager and title reviewer can aid the process of obtaining permanent and temporary work space in the negotiation phase of acquisition. During this phase, we will coordinate with the PWSA legal on all easements and other needed documents. A crucial scope item during this phase of work is the establishment of fair market value for the impacted private parcels that will require either easements or purchase. This will represent a significant initial project cost that will require funds appropriation by the PWSA for early execution. It is anticipated that the real estate transactions will need to be complete prior to release of construction documents to ensure that the construction is conducted within project limits controlled by the PWSA. Therefore, the real estate services will follow an accelerated timeline with completion of the final right-of-way plans coinciding with the 90% design submittal.

Deliverables for this phase of work will be:

- Final right-of-way plan
- Legal descriptions of all right-of-way, easements, property takes, and other needed instruments for the routing of the rising main
- Fair market determinations for each real estate transaction needed to facilitate the legal control of all property within the project limits by the PWSA

90% DESIGN PHASE

The final phase of the real estate services will coincide with the 90% design phase. The work during this phase will start with the confirmation of the design within the context of the final approved right-of-way plan. This will ensure that the grading and other construction effort will fall within the easements, right-of-way, and property limits established by the right-of-way plans. Once confirmed, the focus will shift to coordination with the PWSA's legal team to assist in the negotiation of the real estate transactions with the various property and right-of-way owners. The Michael Baker team assumes that they will support the PWSA legal team through the creation of legal descriptions and figures for each of the transactions with an overall set of plat maps to be recorded in Allegheny County as legal instruments once the transactions are negotiated and ready for execution. It is our assumption that due to the interrelated nature of the transactions, the PWSA will not record any transaction until the required transactions are ready for execution. Thus, we have assumed a single overall plat of dedication to be needed at the end of this phase.

The Michael Baker team will complete any state and local inquiries prior to project kickoff and assist the PWSA with any public relations or informative material delivery. The Michael Baker team will run title on all affected tracts to ensure ownership and organize document preparation. Additionally, we will give input as needed in alignment meetings to properly identify all landowners; work with the PWSA for all legal documents for execution; and attend all municipal and public meetings to support the PWSA.

Deliverables for this phase of work will be:

- Plat of dedication and legal descriptions for all real estate transactions required for the new rising main approved alignment.

J. MUNICIPAL/PUBLIC COORDINATION

The first step in the permitting process will be the coordination with all local municipalities. Michael Baker will coordinate with Aspinwall, Etna, Sharpsburg, Shaler Township, and the city of Pittsburgh to establish a clear path for project reviews and permit approvals by each entity. Where possible, Michael Baker will seek to develop a single standard that will meet all the local municipal standards to allow for a common approach to the design effort, as well as the ability to create a single set of permit plans and specifications for approval by all municipalities. In addition to the local municipal agencies, Michael Baker will coordinate with the county and state to establish the regulatory guidelines for the project at its onset. Michael Baker understands that pro-active coordination is a key element to project success and will shorten the overall duration of the permitting effort.

Additionally, with the significant delays experienced in the past with DEP permitting of PWSA projects, we will work proactively with the agency to develop a plan to provide timely reviews and resubmission of plans with an "early and often" approach to communication with the DEP staff. We will work at the project onset to present the project goals and constraints to DEP, as well as gather their input ahead of official submission, so we can tailor the package to meet their expectations

RAILROAD COORDINATION

Michael Baker will coordinate with Norfolk Southern Transportation as owner of the land and tracks and with Allegheny Valley Railroad as the operator of the tracks. Michael Baker understands that effective railroad co-ordination is essential for the success of this project.

Michael Baker has successfully coordinated with Norfolk Southern on numerous projects | Most recently on the ongoing Pittsburgh Vertical Clearance project

Michael Baker will follow the procedures in **the Norfolk Southern Transportation Public Projects Information** publication and assist the PWSA with obtaining the **Preliminary Engineering Agreement** to start the Railroad coordination process. Michael Baker will gather information such as the number and the speed of trains, possible future track expansion or removal, safety, track clearances, fiber optic lines, water and sewer line crossing design requirements, drainage, site access, construction crossings, track outages, right-of-way, and construction sequencing to avoid conflicts with railroad operations.

Before any personnel from the Michael Baker team enters the railroad property to obtain engineering data, a railroad flagging and protective services agreement will need to be executed with Allegheny Valley Railroad.

Railroad coordination efforts will continue as design progresses and will cover all aspects of the Lanpher Rising Main project. Michael Baker will assist in the review of a railroad force account agreement between the PWSA and Railroad to cover any rail or signal work or protective services that can only be accomplished by Railroad personnel. Michael Baker will also assist with coordination in the preparation of agreements between the PWSA, Norfolk Southern, and PA Public Utility Commission as required. The Michael Baker team has experience with working with Norfolk Southern and various railroad customers and understands that the permitting process can be long; early coordination will be essential.

UTILITY COORDINATION

Early and frequent utility coordination is imperative to the success of this project and **the Utility Coordination process will begin during the Preliminary Design Phase of the Lanpher Rising Main Project.** The Michael Baker team will use the information found during the investigation of the PWSA's existing documents and the PA One Call to further contact and discuss the project with the respective utility

owners/representatives, including the Norfolk Southern Railway as described above and the municipalities to discuss the locations of sewers that may conflict with the proposed design layout. The Michael Baker team will prepare documents and set meetings, if required, to discuss this project with the various utilities and what site sensitivities there may be. This will be especially important with Norfolk Southern's crossing as well as the crossing of multiple large combined sewer mains.

COMMUNITY ENGAGEMENT

The Michael Baker team includes **experts in stakeholder-driven master planning** for communities and districts of various sizes and we propose a modified application of our charrette process to engage Pittsburgh's stakeholders. The approach will produce a plan that demonstrates true community and stakeholder ownership of the proposed routing of the Lanpher Rising Main. We will engage with the community groups, such as New Sun Rising, the Etna Economic Development Corporation, and the Sharpsburg Neighborhood Organization, as well as local governmental agencies, including ALCOSAN, the URA, the PCC, and the City DPW.

The Michael Baker team specializes in public outreach and uses a variety of techniques and platforms to creatively stimulate public input. These strategies include traditional public meetings, demonstration projects, streamlined crowdsourced applications, project websites, and interactive surveys.

As an early step, we will begin reaching out to stakeholder organizations and community groups. We will work with these partners to reach out to their members. We anticipate a single workshop to present the potential alignment options to get input from the various groups. Since there are no permanent changes to the project area above grade, the process will be focused on the temporary changes due to construction and the steps taken to mitigate the impacts on residents and businesses.

Our workshops are designed in such a way that public representatives such as residents, business owners, and community members can be meaningfully engaged at an event along with technical experts and other agency stakeholders. This helps to drive consensus-based decisions that are rooted in reality - and more likely to be implemented. Our workshop process guides participants through a series of exercises that prepare them to propose, discuss, debate, and ultimately choose from a variety of options.



In the lead-up to the public engagement workshop, we will work with partner organizations to get the word out, share brief online surveys, and provide DIY materials for groups who cannot attend the event but want to share their thoughts.

Michael Baker will work with Brean Associates during Task 2's Community Engagement and Public Outreach. Over the past 20 years, Brean Associates has built a solid reputation through three core strengths:

- Fair and neutral facilitation
- Bridging the gap between stakeholder involvement and technical expertise
- Navigating complex systems to reach consensus among diverse stakeholders

As an active and integral member of the Michael Baker team, Karen Brean will:

- Develop, in collaboration with PWSA staff, a public and municipal engagement plan that identifies municipal and public meetings to be conducted during the project
- Develop and maintain a list of key community and municipal stakeholders in the project area
- Work with the Michael Baker team and the PWSA Community Relations staff to organize and prepare for municipal and community meetings
- Attend, facilitate, and document municipal and community meetings

Successful collaborative planning requires skilled, informed, and neutral facilitation. In preparing for public meetings, Karen Brean will educate participants to have informed discussion of solutions identified by the project team. She will make sure that the participants are using the most effective methods for accomplishing their task in the shortest time. To achieve this, she will:

- Engage the participants
- Keep the group focused and on task
- Facilitate individual participation
- Respond to group needs
- Accurately report on the meeting results

K. CONTRACT DOCUMENTS

The Michael Baker team will finalize the contract documents that have been developed throughout the design process. The Construction Specifications will use the Construction Specification Institute (CSI) 2004 format for all aspects of the proposed work for the Lanpher Redundant Rising Main Project. All documents will be combined and assembled into a complete project manual and bidding documents. Once again, throughout the design process, the project will be reviewed to set limits of work that have been value engineered and customized to create multiple sub-projects that will enable small and minority business participation in the construction of the project. These smaller projects will generate the need to produce multiple sets of final construction documents and bidding packages to incorporate each sub-project.

L. PROJECT COORDINATION

Michael Baker understands that no project exists within a vacuum and that there are points of coordination with other projects that are required. In the case of the Rising Main, coordination will be required with the teams that are working to develop the clear well solution, as well as the Lanpher Reservoir rehabilitation. Items that will require specific coordination are the impact of the rising main alignment on the residency time for the water to achieve proper chlorination contact, as well as the functional system curve of the pipe system and its impact on the pump performance curve. These two items are interrelated and will require close coordination to ensure that the water supply is properly treated and meets the Safe Drinking Water standards. Additionally, the discharge into the reservoir will need to be coordinated to ensure that the location, velocity, and configuration of the discharge works cooperatively with the long-term designs for the reservoir.

As required by the RFP, Michael Baker has allowed for five meetings with a duration of two hours for working directly with the PWSA and their respective design teams on the related projects.

TASK 3: BIDDING PHASE SERVICES

Once the final design plans are approved and the complete bid packages are assembled, the PWSA will release the project for bidding. During the bidding phase period, Michael Baker will remain engaged and will assist the PWSA throughout the bidding process. We will maintain continuity of the design team with the bid phase to ensure that the design intent is carried through this task. The initial support will be through the attendance at the pre-bid meeting. Michael Baker will attend the pre-bid and provide technical support to present the design and offer an overview of the project to the interested bidders. It is anticipated that all questions will be required to be submitted as an RFI and that Michael Baker will provide responses to the bidder inquiries.

BID REVIEW AND EVALUATION

Once the bid period has ended, Michael Baker will assist the PWSA with a Bid Review and Verification of all bids. The review will ensure that the bids are responsive and meet all requirements of the project documents and that the proper bonding and other required documentation is included.

If any deviations or Value Engineering Proposals are provided as part of any bidders' response or alternates listed, and the PWSA decides to allow the bid to be reviewed, Michael Baker will review the deviation and/or alternate for conformity with the design intent. If the alternative is deemed to be consistent with the design intent, Michael Baker will consult with the PWSA as to the value of the alternate approach and the impact on the rising main service life, as well as the cost benefit of the change.

Once each bid is initially evaluated for responsiveness, it will be reviewed for pricing both from a unit price and overall contract amount. The combination of the review will be utilized to rank the bids with any non-responsive bid being excluded from consideration. Michael Baker will provide a letter that outlines the evaluation and ranks the bids for the PWSA to review and make an Award Selection.

GEOTECHNICAL SERVICES

Michael Baker will provide geotechnical consulting services to support the bidding phase of the project. Michael Baker will provide answers and clarifications to geotechnical related questions, as requested by the PWSA.

TASK 4: COORDINATION DURING CONSTRUCTION

PRECONSTRUCTION MEETING

After the bidding phase is complete and the contract is awarded, Michael Baker will continue to support the PWSA through the execution of construction phase services. The construction phase services will begin with the attendance at the pre-construction meeting to support the PWSA in initiating the contract work with the successful bidder. Michael Baker will aid in any questions and concerns related to the construction of the proposed designed improvements, which may include tunnel, material, transmission line alignment, and geotechnical concerns.

A critical success factor in the relocation of utilities is the proper overview of the construction activities.

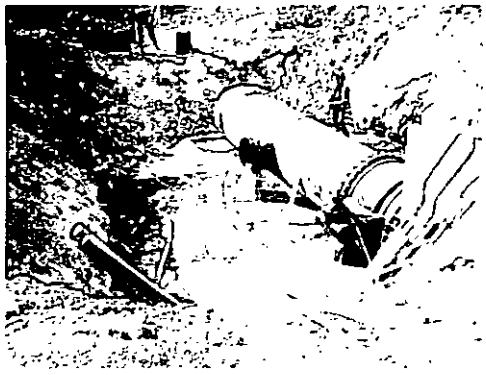
SUBMITTAL REVIEWS AND REQUESTS FOR INFORMATION

The Michael Baker team will provide technical support to the PWSA in presenting the design, anticipated phasing, and sequencing, as well as the procedure for submittals and construction phase RFIs. The Michael Baker team will review submittals from the contractor related to the trenchless design, restoration elements, and general questions on plans, schedules, materials, etc. All submittals will be responded to within 15 calendar days of the receipt from the PWSA. The Michael Baker team will respond to requests for information (RFIs) related to trenchless, alignment, trenching, materials, restoration, and general design elements of the proposed plan no more than five days of receipt from the PWSA.

Our commitment to the project continues through construction and submission of final record documents.

SITE VISITS

Once construction has begun, the Michael Baker team will perform site visits to periodically review construction progress and attend construction meetings to provide support to the contractor and the PWSA in the execution of the design. We have allowed for two site visits per month to allow for a frequent presence on site while limiting the overall cost of the support. It is assumed that at least one of the two monthly visits will also include a construction progress meeting.

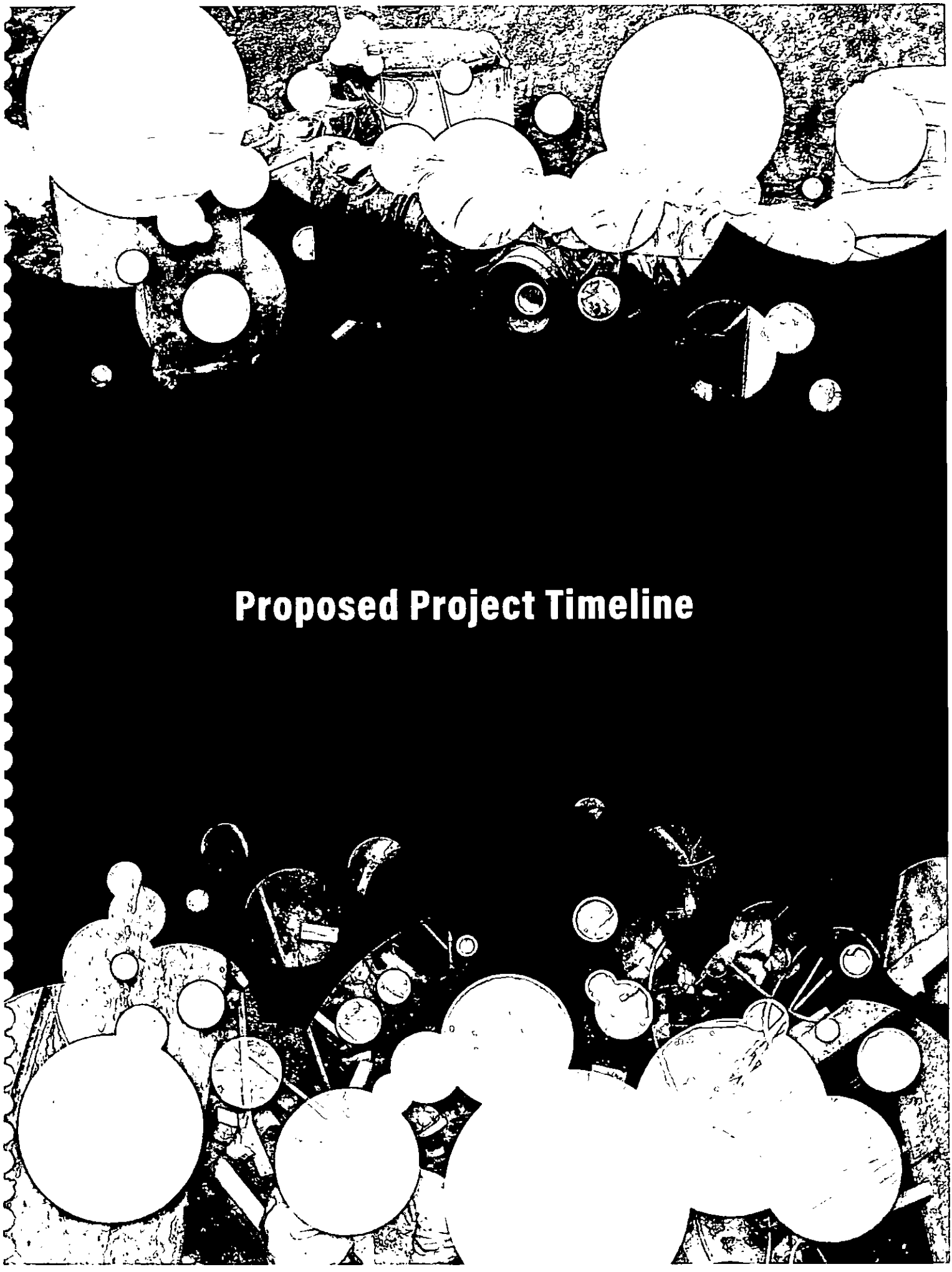


PWSA 60" waterline valve installation

In addition to the immediate support provided via submission review, RFI responses and site visits, the Michael Baker team will also provide coordination with the PWSA Project Manager to support the overall administration of the project. This coordination will be to provide answers to questions and requests made by the PWSA in support of their administration of the project. **If the PWSA elects to award multiple sections of the project to different contractors, we anticipate the need for support to be greater than if a single contractor is awarded the overall project.** In this scenario, the PWSA would take on the role of construction manager for the coordination effort between the various contract sections. Michael Baker would have the ability to provide enhanced services in this event to provide the overall schedule management and track all efforts to ensure a coordinated execution.

GEOTECHNICAL SERVICES

Michael Baker will provide geotechnical consulting services to support the construction phase of the project specifically on submittal reviews, responses to requests for information, attend progress meetings as requested, Construction site visits as requested, participation in Final Inspection, and review Final Record Drawings.



Proposed Project Timeline

SECTION 3: PROPOSED PROJECT TIMELINE

DIFFERENTIATOR

DETAILED CRITICAL PATH METHOD-BASED SCHEDULE

As part of our proposal process we clearly understand that "time is of the essence" regarding the execution of this project. Therefore, in developing our project schedule, we have elected to develop a comprehensive CPM-based schedule for the overall project timeline as a value-added approach to our response. The Notice to Proceed is assumed to be Jan. 2, 2019 as instructed in the RFP.

We have developed a schedule that addresses the major tasks and sub-tasks of each key focus areas of the project. However, instead of showing them as separate items, we have integrated the entire process to show the project timeline as it would unfold in execution. This approach allows the PWSA to understand the interconnected nature of the work tasks and the items that will encompass the critical path. The value in developing this as part of the RFP response is the comprehensive understanding of the entire process and the complexity involved in developing the design. We also developed the schedule in this nature to better understand the relationship of the work tasks and real-world timelines for execution to allow us to understand the magnitude of the work effort, as well as tasks that must be executed concurrently in a means to understand the staffing levels needed for execution.

This approach will ensure that the PWSA will have confidence in the Michael Baker team's clear understanding of project sequence, magnitude, and level of effort throughout the design life of the project through project construction and closeout. We will invoice the PWSA monthly throughout the project. Since the billing method is regular and predictable, we have not included it as part of the project timeline or milestones.

CPM SCHEDULE ASSUMPTIONS

We have made the following assumptions while creating our project schedule:

- The Notice to Proceed will be issued on Jan. 2, 2019
- All materials to facilitate the initial preliminary design review will be provided on Jan. 2, 2019, at the kick-off meeting
- The wetland assessment can be conducted in winter to determine the maximum extents of any wetland or riparian areas with the understanding that we will implement a trenchless solution for the pipe installation in the areas where they will occur
- All permitting agencies will be available to meet early in the process for the pre-application and permitting kick-off
- Only one workshop will be needed
- We have assumed a two-year window for construction based upon the assumption of 40 linear feet of pipe installation (average) per day and a five-day-a-week schedule

ID	Task Name
1	**Lanpher Rising Main Design**
2	Preliminary Design
3	Notice to Proceed
4	**Kick Off Meeting**
5	**Review 2016 Fesibility Study**
6	**Gather existing record information**
7	**Field view**
8	**Create record based Existing Conditins plan**
9	**Phase 1 Environmental Assessment Report**
10	Records Research
11	Field Work
12	**Report**
13	**Workshop**
14	**PADEP Pre-Application Meeting**
15	**PWSA Review**
16	**Preliminary Design Review Meeting**
17	30% Design
18	**Phase 1 Environmental Assessment Report**
19	Historic Assesment
20	Wetland and Riparian Resources Investigation
21	ESA Report
22	**Geotech**
23	Clearances to drill
24	Drilling program
25	Testing
26	Report
27	**Survey**
28	Mobile LiDAR
29	Preliminary Survey Creation
30	Total Station Field survey
31	Final Survey Creation
32	**SUE**
33	Records Research
34	One Call
35	Field Locate
36	GPR + Non-desructive
37	Pot Hole Testing
38	**Real Estate Services**
39	Deed research

: Quarter | Mar | May | 3rd Quarter | Jul | Sep | Nov | 1st Quarter | Jan | Mar | May | 3rd Quarter | Jul | Sep | Nov | 1st Quarter | Jan | Mar |

Project: Lanpher Rising Main Design Schedule.mpp
Date: Thu 9/13/18

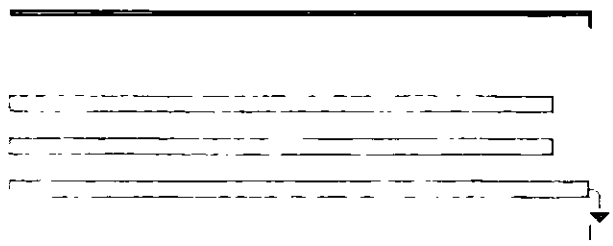
T

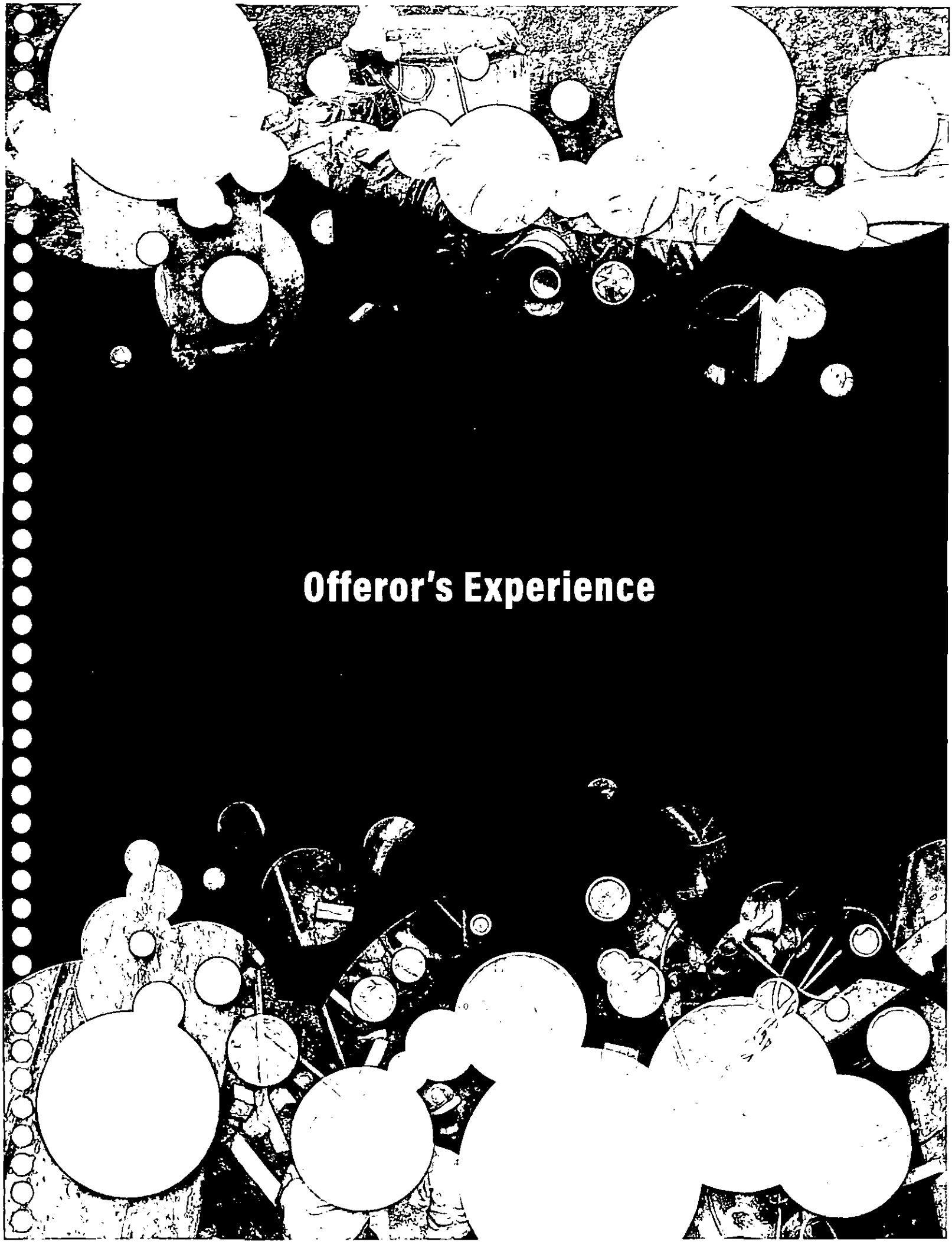
PGH2O Michael Baker INTERNATIONAL

ID	Task Name
40	Property research
41	*Initial involved parcels determination*
42	Concept easement and property take plan
43	**Specifications**
44	**MPT Plan**
45	**Rising Main Plans**
46	**Opinion of Probable Construction Cost**
47	**Value Engineering Review**
48	**Constructability Review**
49	**PWSA 30% Review**
50	**30% Design Review Meeting**
51	60% Design
52	**Geotechncial**
53	**Specifications**
54	**MPT Plan**
55	**Rising Main Plans**
56	**Real Estate Services**
57	Finalize parcel acquisition and easement pla
58	Finalize Legal descriptions
59	Property acquisition support
60	Record property transfer and easements
61	***Opinion of Probable Construction Cost***
62	**Value Engineering Review**
63	**Constructability Review**
64	**PWSA 60% Review**
65	**60% Design Review Meeting**
66	90% Design
67	**Geotechncial**
68	**Specifications**
69	**MPT Plan**
70	**Rising Main Plans**
71	**Opinion of Probable Construction Cost**
72	**Value Engineering Review**
73	**Constructability Review**
74	**PWSA 90% Review**
75	**90% Design Review Meeting**
76	100% Design
77	**Specifications**
78	**MPT Plan**

t Quarter | 3rd Quarter | 1st Quarter | 3rd Quarter | 1st Quarter
n Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar

ID	Task Name
79	**Rising Main Plans**
80	**Opinion of Probable Construction Cost**
81	**Constructability Review**
82	**PWSA 100% Review**
83	**100% Design Review Meeting**
84	Bid Phase Services
85	**Pre-Bid Meeting**
86	**Contractor RFI Response**
87	**Bid Review**
88	**Award Recommendation**
89	Construction Phase Services
90	**Pre-Bid Meeting**
91	**Submittal Reviews**
92	**RFI Reviews**
93	**Site Visits**
94	**Punch List**
95	Permitting
96	**PADEP Permitting**
97	Water Distribution System
98	Safe Drinking Water
99	**ACCD Permitting**
100	**Municipal Permits**
101	**PennDOT Highway Occupancy Permit**
102	**CSX Right of Way & Utility Permit**
103	**Pittsburgh DPW/DOMI Permits**
104	Roadway Opening Permit
105	Traffic Obstruction Permit
106	Land Operations Permit
107	Encroachment Permit
108	Stormwater Concurance
109	**Army Corps of Engineers**





Offeror's Experience

SECTION 4: OFFEROR'S EXPERIENCE

DIFFERENTIATOR

THE PWSA HAS TRUSTED MICHAEL BAKER WITH ITS PROJECTS SINCE 1983

The PWSA and Michael Baker have partnered successfully for more than 30 years to help solve our region's complex engineering challenges / Through this experience, Michael Baker has gained a thorough knowledge of the PWSA water, sanitary/combined sewer, and storm sewer systems. Michael Baker is familiar with the PWSA standards, rules and regulations, and permitting requirements and has extensive experience with the regulatory and government agencies that the PWSA considers stakeholders on many of its projects. Additionally, we understand the issues facing the PWSA, including aging and failing infrastructure, strict federal and state regulatory requirements, and water quality. Much of Michael Baker's history with the PWSA has been primarily on large-scale asset/feasibility studies and engineering design projects. This experience has been developed by working for the PWSA since 1983 and assisting the PWSA with some of its most important projects, including:

- Bedford Tank
- Highland Park Reservoirs Covers Study
- Fox Chapel Pump Station & Rising Main
- PWSA CSO Feasibility Study
- Catch Basin Condition Assessment and Cataloguing
- Sheraden Park Stream Removal
- Millvale Industrial Park Sewer Separation
- GIS Base Map Development
- COA Reports
- Herron Hill Reservoir
- Mission Street Pump Station Inspection
- Stormwater Utility Feasibility Report
- Stormwater Fee Implementation
- Waterline Curb Stop Inspection Program

In addition to our extensive experience with the PWSA, Michael Baker has been providing civil engineering design and construction services for numerous municipalities in Western Pennsylvania for more than 75 years. We are a local provider with access to extensive national and international resources and expertise. Listed below is just a sample of some of the closely-related projects Michael Baker has completed locally with similar challenges:

PROJECT	COMPLEX CHALLENGES FACED	SOLUTION/RESULT
S.R. 28 Utility Relocation Design	• Extensive utility coordination • Multiple stakeholder involvement • Major traffic and construction sequencing issues • Buildings of historic significance	• Cost-effective design that addressed the needs of the utility companies • Design that addressed concerns relating to traffic issue and construction sequencing
Centre Avenue	• Large diameter pipeline (36" – 54") installation on a major street situated in an urban business/entertainment district. • Work site directly at the front entrance of the PPG Paints Arena	• Extensive records research and base mapping resulted in no construction phase conflicts in the field. • Extensive coordination and schedule constraints in the contract to minimize disruption to surrounding businesses.
Lower Hill Redevelopment Site Sustainability Design	• Full infrastructure to support large-scale development • Multiple community involvement • Complex permitting issues • Aggressive client schedules • Plethora of existing sub-surface and conflicting utilities	• High-tech, cost effective infrastructure to meet current and future needs • Thriving retail businesses benefitting municipalities • Community growth • Sustainable Green Stormwater Infrastructure • First Flush (1.5") Rainfall Capture and CSO Mitigation
Pine Hollow Storm Sewer Engineering & Environmental Services	• Aggressive schedule based on Federal Funding	• Frequent stakeholder meetings

PROJECT	COMPLEX CHALLENGES FACED	SOLUTION/RESULT
	• Restricted corridor for construction • Complex utilities	• Pre-application meetings for permit packages • Involvement with construction phases
East Princess Anne & Nimmo Parkway Force Main Replacements	• Congested Urban Roadway Corridors • Trenchless Technologies • Significant Traffic Control Issues • Multiple Jurisdictional Stakeholders	• Coordination and Sequencing • Microtunneling and Horizontal Directional Drill • Traffic Control Workshop • Early Stakeholder Involvement
Warwick Boulevard to James River Influent Force Main	• Urban Roadway Corridor • Traffic Control Issues • Landscaping/Tree Protection • Continuity of Service	• Phasing and Sequencing • Traffic Control Workshop • Public Outreach for Landscaping • Use of Linestops and Bypass Piping

DIFFERENTIATOR

CURRENT AND PAST EXPERIENCE WITH LARGE DIAMETER WATER LINES

The Michael Baker team has not only local experience but experience throughout the east coast with the layout, design, and installation of large diameter utilities, including waterlines. Under the Pennsylvania Department of Transportation's (PennDOT's) State Route 28 East Ohio Street reconstruction project (between city of Pittsburgh and Millvale), Michael Baker was required to design for the relocation of the PWSA's water and sewer facilities. This included relocation of approximately 1,400 linear feet of a 60-inch water transmission line, and 6,800 linear feet of a 24-inch water transmission line in an urbanized area with high traffic volume. This project included numerous road crossing, tunnel operations, maintenance of traffic, and working within tight rights-of-way. This experience is essential to the design of the large diameter redundant Lanpher Rising Main.

Additionally, our team has completed the following large diameter waterline relocation projects in urbanized areas:

TEAM EXPERIENCE - LARGE WATER PIPELINE PROJECTS

PROJECT	CLIENT	PIPE DIAMETER (INCHES)	PIPE LENGTH (FEET)	PIPE MATERIAL	HYDRAULIC MODELING	EVALUATION PHASE / ROUTE STUDY	INTER-JURISDICTIONAL COORDINATION	PERMITTING ISSUES	PUBLIC AWARENESS PROGRAMS	SPECIALTY CROSSINGS	EASEMENT/ PROPERTY ACQUISITION	ARCHAEOLOGICAL SERVICES	CORROSION CONTROL	CONSTRUCTION SERVICES	WATER MAIN RELOCATIONS	HYDRAULIC FACILITIES / SPECIALTY
Route 28 Corridor	**PennDOT**	**24"/60"**	**7,900**	**DI**		✓	✓	✓	✓	✓	✓	✓		✓	✓	
342 Pressure Zone Improvements - Phase I	**Stafford County**	**24**	**25,000**	**DI**				✓	✓	✓	✓					✓
Lake Manassas WTP to Dean Tank Transmission Main	**City of Manassas**	**24/36**	**40,000**	**DI**	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓

TEAM EXPERIENCE - LARGE WATER PIPELINE PROJECTS																
Braddock Road Transmission Main	**Fairfax Water**	**24**	**12,000**	**DI**		✓		✓	✓		✓		✓	✓	✓	✓
South Kings Highway Transmission Main	**Fairfax Water**	**24**	**12,000**	**DI**		✓		✓	✓	✓	✓		✓	✓	✓	✓
Lee Highway Transmission Main	**Fairfax Water**	**24**	**10,000**	**DI**		✓		✓	✓	✓	✓		✓	✓	✓	✓
I-495 HOT Lanes	**Fairfax Water**	**24/30/42/54**	**23,700**	**DI**		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Crittenden Road / Route 17 Water Main	**City of Suffolk**	**24/30/36**	**73,000**	**DI**	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Lake Gaston Water Supply Main	**City of Virginia Beach**	**60**	**400,000**	**DI/PCCP/ WSP**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Fox Mill - Centerville Water Main	**Fairfax Water**	**42**	**50,000**	**DI**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Route 123 Water Main (Phases II & III)	**Fairfax Water**	**30/42**	**18,500**	**DI/WSP**		✓		✓	✓	✓			✓	✓	✓	
Fox Mill Road - Vale Road Water Main	**Fairfax Water**	**36**	**10,000**	**DI**		✓		✓	✓	✓	✓		✓	✓		✓

DIFFERENTIATOR

UNPARALLELED TEAM EXPERIENCE WITH UTILITY RELOCATION DESIGN IN THE PROPOSED PROJECT AREA

PROJECTS PERFORMED WITHIN THE LAST FIVE YEARS

S.R. 28 UTILITY RELOCATION DESIGN

PITTSBURGH, PENNSYLVANIA

Michael Baker
INTERNATIONAL

CLIENT
PennDOT, District 11-0
Cheryl Moon-Sirianni | 412.429.5005
csirianni@state.pa.us

COMPLETION DATE
2014

COSTS
$100,000,000 (construction)
$2,994,430 (fee)

MICHAEL BAKER'S ROLE
Data collection and analysis
Field investigations
Utility surveying and mapping
Three-dimensional modeling
Utility coordination
Water and sewer relocation design

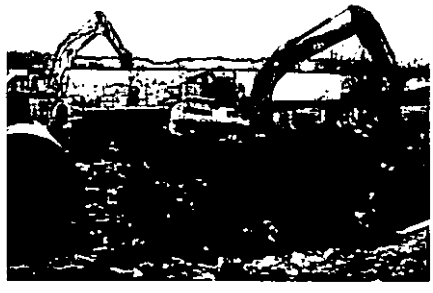
Michael Baker provided engineering services for the extensive utility relocations that were required for the preliminary and final design for the reconstruction of S.R. 28 (East Ohio Street), from downtown Pittsburgh to Millvale. Michael Baker's services included record research; field investigations; utility surveying and mapping; three-dimensional modeling; utility coordination; and relocation design of water and sewer infrastructure and coordination of electric, telephone, and cable television utilities.

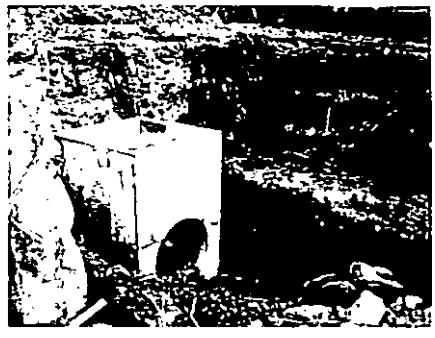
S.R. 28 is a highly traveled roadway nestled between a steep hillside and Norfolk Southern Railroad tracks that dates back more than a century as a critical transportation corridor. The roadway reconstruction plans called for significant line and grade changes to the roadway, adjacent railroad, and the 31st and 40th Street bridges. Impacts to the utility systems were extensive, and were further complicated by their significant age, unknown integrity, and undocumented locations. To minimize the risk of system failure during or after construction, it was determined that virtually every utility within the corridor would have to be replaced, rehabilitated, or decommissioned as part of the project.

Among the primary facilities that were affected were large-diameter water and sewer lines that were owned by the **Pittsburgh Water and Sewer Authority**, an Equitable Gas Company, 20-inch transmission main, Duquesne Light Company electric transmission duct banks, Verizon fiber-optic duct banks, and a host of secondary systems.

Due to the uncertainty of the line, grade, and condition of many of the utilities, Michael Baker conducted extensive data research and provided oversight for significant design-phase field investigations by subcontractors that specialized in locating and documenting underground utilities using closed-circuit television inspection, vacuum-assisted test pitting, conventional machine test pitting, and electronic pipeline tracing and underwater sonde methods. Michael Baker used the data to develop three-dimensional models for use with InRoads design software.

Michael Baker developed the design for the relocation of the PWSA water and sewer facilities as incorporated work in the roadway design. Major facility relocations included approximately 1,400 linear feet of 60-inch water transmission main, 6,800 linear feet of 24-inch water transmission main, 475 linear feet of 36-inch combination sewer and storm drainage, and 825 linear feet of 16-inch combination sewer and storm drainage. Included was construction of a major pipe junction at the former Millvale Industrial Park site which enabled an interconnect of the relocated 60" waterline and the 24" waterline that services the North Side neighborhood.





The unique riveted steel construction of the existing 60" waterline, more than a century old, required specialized design of transition couplings required to connect the new 60" ductile iron pipe to the existing steel pipe. Specifications were developed to ensure that the general contractor employed the services of a welding/fabrication subcontractor who was experienced with fabrication of the unique, specialized transition fittings required to make the connections.

Due to the need to construct these major facilities while maintaining traffic, Michael Baker designed numerous utility crossings to be installed beneath the active roadway. As these crossings were large diameter, relatively short in length, and located within tight rights-of-way, the contractor performed a manual tunneling operation, in which workers using miniature excavation equipment advanced a liner-plate system along the alignment, rather using than a conventional jack and bore or microtunneling operation. The PWSA work was performed by the general contractors for the various phases of construction.

A highlight of the design was the opportunity to reduce storm sewer flow from the project area into the adjacent Allegheny County Sanitary Authority (ALCOSAN) interceptor sewer. The ALCOSAN system, now under a federal consent decree, discharges combined sewer overflow into the Allegheny River during storm events. Michael Baker designed the new roadway storm sewer system to remove virtually all the storm flow that had previously entered the ALCOSAN sanitary system. The project resulted in ALCOSAN being able to decommission two sewer diversion structures adjacent to the project. Through a complex intermunicipal agreement and piping layout, flow from adjacent Reserve Township was able to be diverted to the PWSA system to enable closure of diversion A-66, which was in the Allegheny River back channel, a popular boating and recreational area.

The relocation of gas, electric, and telephone utilities along the corridor was the responsibility of the respective utility owners, but their plans had to be fully integrated into the project and coordinated regarding scheduling, phasing, and proximity to existing and proposed work. Equitable Gas had a major 20-inch steel transmission line that ran the entire length of the project. Due to the age of the pipe and extensive interference with the proposed work, the gas company elected to replace approximately 9,700 linear feet of 20-inch steel pipe in sections that coincided with the project phases. Michael Baker closely coordinated with the general contractors for the various phases to ensure that conflicts with existing and proposed facilities were minimized.

Duquesne Light Company, Verizon of Pennsylvania, and Comcast Cable Television had both primary and secondary facilities within the project area. Most of the secondary facilities were terminated, as dozens of residential and commercial buildings were razed for the project. Major duct bank relocations for Duquesne Light Company and Verizon were required at the 31st and 40th Street bridge intersections. The 31st Street Bridge was partially reconstructed as part of the project and required close design coordination with the structural engineers to enable placement of new duct banks on the complex structure.

CENTRE AVENUE STORM SEWER

PITTSBURGH, PENNSYLVANIA

Michael Baker
INTERNATIONAL

CLIENT
Sports and Exhibition Authority
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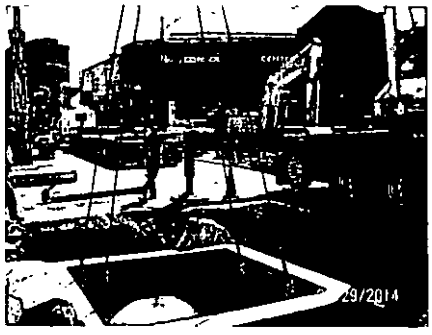
COMPLETION DATE
2014

COSTS
$1,266,000 (construction)
$125,000 (fee)

MICHAEL BAKER'S ROLE
Hydraulic modeling
Storm sewer design
DEP permitting
Erosion & sedimentation control design
Maintenance & protection of traffic design
PennVEST loan application assistance
Construction phase consultation



Michael Baker provided storm sewer modeling, system design, and permitting for the Centre Avenue storm sewer project, which is situated on a major city street abutting the Lower Hill Redevelopment Site, a 28-acre parcel adjacent to Downtown Pittsburgh on the land formerly occupied by the Pittsburgh Civic Arena. The parcel is controlled by the Sports and Exhibition Authority of Pittsburgh and Allegheny County (SEA) and the development rights are held by the Pittsburgh Penguins. Following construction of the new PPG Paints Arena, the Civic Arena was demolished to make way for a high-profile redevelopment project.

In conjunction with the redevelopment of the 28-acre site, there was a commitment to separate existing Pittsburgh Water and Sewer Authority (PWSA) combined sewers, both within the development site and on adjacent streets. Separation of existing sewers into dedicated sanitary and storm systems is part of an ongoing effort to ensure that new developments minimize conveyance of storm sewer flow into existing combined sewer systems, thus helping efforts to control combined sewer overflows.

During preliminary planning activities and coordination with the PWSA, it was determined that new storm and sanitary sewers from the development site would all connect to the Centre Avenue system. The PWSA indicated that their long-term plans called for separation work along the Centre Avenue corridor, both upstream to other developments and downstream to a future river outfall. Michael Baker performed hydraulic modeling, system design, and permitting for construction of a new storm sewer adjacent to the site to enable future separated sewers from the development parcel and upstream areas to connect directly to it.

Michael Baker performed extensive hydraulic and hydrologic (H&H) modeling of the existing system to determine storm sewer design flowrates, including accommodations for future upstream separated flow from other developments, as well as storm sewer flow from the Lower Hill redevelopment parcel. Since development of the future river outfall was a separate project to be designed and constructed by the PWSA at a later date, accommodations were made at the lower terminus of the sewer to reconnect to existing sewers while providing an outlet stub for the future river outfall line. Various scenarios had to be considered for the system to be designed for future conditions both upstream and downstream, including interim connections. Ultimately a storm sewer, ranging from 36 inches to 54 inches in diameter, was designed to convey the flow.

Because the project included modifications to the existing 36-inch PWSA combination sewer, the Pennsylvania Department of Environmental Protection required that a "Part 2" permit application be filed for the project. Preparation of the permit application required information related the H&H modeling work, as well as development of design plans and specifications for the work.

Design of the storm sewer and related combined sewer modifications was performed and included provisions for future upstream extension and connections, future development

parcel connections, separation of roadway catch basins along Centre Avenue, and a special terminal manhole with provisions for connection to the existing sewer and a stub for the future river outfall line.

The project site was located on the block of Centre Avenue immediately in front of the new PPG Paints Arena. In addition to consideration for disruption of the roadway in front of the busy facility, the corridor was also a major artery for Port Authority bus routes. Maintenance and protection of traffic plans (M&PT) were prepared and included provisions for maintaining access to the building, as well as the parking facilities on the opposite side of the street. Special considerations for pedestrian movement during events were accommodated on the M&PT plans, ensuring that the contractor would have safe pedestrian routes from the parking lot, across the sewer construction area, and then to the facility. Detour plans were coordinated with the Port Authority to ensure that changes in bus routing were able to be made during construction. Test detours were conducted in advance of the project and several minor pavement adjustments on the detour route were identified to keep the busses from bottoming out on the steep street grades and intersections along the detour route. Also included in the project was full curb to curb resurfacing of the affected lane of Centre Avenue to ensure that the area would be left in better condition than what was currently there.

The client, in conjunction with the PWSA, determined that funding for the project would best be accommodated through a PennVEST loan. Michael Baker assisted with providing documents to the PWSA to support the loan application and ensured that the process was fast tracked to meet the required deadlines.

Michael Baker prepared final construction plans and specifications, and the project was bid by the SEA, with construction inspection to be provided by the PWSA. Ultimately, the completed system would be turned over to the PWSA for ownership. Construction bidding and award was timed to coincide with the summer off-season at PPG Paints Arena, with completion targeted to occur just before the start of the Penguins' fall season in 2014.

Construction commenced in early 2014 and ran through the summer. The complexity of constructing a 54-inch sewer and large manhole structures within the confines of a busy city street was significant, especially since the construction site was sandwiched between PPG Paints Arena and its adjacent parking lots across the street. However, the many accommodations within the contract, as well as planning with all affected entities, made for a smooth process. The project was completed on time and within budget, with the newly resurfaced street in place just prior to the start of the fall hockey season.

LOWER HILL REDEVELOPMENT SITE SUSTAINABILITY DESIGN

PITTSBURGH, PENNSYLVANIA

Michael Baker provided full-service site civil, transportation, and sustainable infrastructure design and engineering for the Lower Hill Redevelopment Site, a 28-acre parcel situated adjacent to Downtown Pittsburgh on the land formerly occupied by the Pittsburgh Civic Arena. The parcel is controlled by the Sports and Exhibition Authority of Pittsburgh and Allegheny County (SEA), and the development rights are held by the Pittsburgh Penguins. A master planning process took place for the development of a new high-quality, sustainable project with open spaces and residential, commercial, office, and hotel uses that will establish a renewed connection between Downtown Pittsburgh and the Hill District.

A Preliminary Land Development Plan (PLDP) was created with input from an array of stakeholders and has been used as the basis for design development of both public and private infrastructure. The plan incorporates expectations of innovative sustainability initiatives. The development earned a certification as a LEED Neighborhood Development rated project. While sustainable design within private development parcels is quite commonplace, the project boasts one of the largest installations of sustainable design elements within the public rights-of-way.

Following approval of the PLDP, Michael Baker commenced design of the site roadways and utility infrastructure, with the goal of providing optimum parcel accessibility. The ultimate owner of the public street grid is the city of Pittsburgh, so all design was performed in accordance with its standards and followed its submission and approval process. It was understood from the onset of the project that construction would be phased to coincide with available funding, so the design was developed to be constructed in four separate phases.

With its high-profile location, the project had to be coordinated with a multitude of stakeholders, including the city of Pittsburgh, Urban Redevelopment Authority, Pittsburgh Water and Sewer Authority, PennDOT, and the Pittsburgh Penguins. Michael Baker assisted with applications for various funding grants throughout the duration of the design process.

The project design featured all new utility infrastructure within the 28 acres. Extensive coordination with the Pittsburgh Water and Sewer Authority (PWSA) was required throughout the design process as all new water and sewer facility construction was integrated into the prime contracts for the four phases. The sewer systems were designed to fully separate storm and sanitary flows within the site and connect to recently separated sewers on Centre Avenue that were constructed as part of a related advance contract to support the site development. The project was designed to comply with the PWSA's master plan and ultimately will be a key component of a completely separated sewer system in the area.

Specially-designed multi-cell stormwater infiltration basins are incorporated into the streetscape amenities. These cells are designed to infiltrate the first 1.2 inches of rainfall from a storm event by capturing and conveying the flow from the roadway and sidewalk

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COMPLETION DATE
2017

COSTS
$15,000,000 (construction)
$1,890,000 (fee)

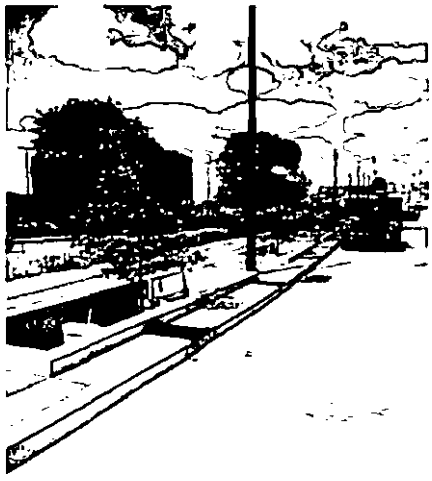
MICHAEL BAKER'S ROLE
Roadways and sidewalks
Signalized Intersections
Green infrastructure
Storm and sanitary sewers
Water distribution system
Utility coordination
Street trees, street lighting, and street amenities
Historic and archival research
Phase I and II archaeological survey
Phase II archaeological testing
Boundary survey and control
Construction phase support





areas into special curb inlet grates. Upon entering the cell, the flow first passes through a specially blended aggregate bed designed to neutralize the effects of wintertime road salt. The flow is then distributed to the downstream cells where multiple layers of subsurface aggregate and soil return the water to the underlying subgrade. Provisions direct excess flow back to the conventional drainage system. The benefit is reduced flow to the city of Pittsburgh combined sewer system.





The site design features all underground utility systems with provisions to accommodate future development of the parcels bounded by the new street grid. Michael Baker provided extensive coordination with utility providers for gas, electric, telephone, and cable services, and assisted with the layout of their facilities within the confines of the project rights-of-way to ensure that they would not conflict with the various streetscape amenities or the PWSA water and sewer systems.

The ribbon-cutting ceremony for the initial phase was conducted on October 10, 2016. The opening of the first segments of the street grid brought promise for development of the parcels to begin in accordance with the overall master plan. The site also promotes reconnection of long-gone street segments linking the Hill District to the Downtown Pittsburgh business district. Additionally, the lower portion of the site abutting the downtown area will foster enhanced public amenities designed to complement the adjacent PPG Paints Arena.

As the largest engineering firm headquartered in Pittsburgh, Michael Baker was proud to have played a key role in the redevelopment of this coveted parcel of land. The project showcases Michael Baker's diverse design capabilities which seamlessly were integrated to provide this showcase project to the city of Pittsburgh.

EXECUTIVE SOLUTIONS ASSOCIATES

SA Solutions

While under previous employment, Ken Crawford led the engineering design and construction document and permit development for infrastructure improvements as a subconsultant to Michael Baker International for the mixed-use, multi-phased redevelopment of the former Pittsburgh Penguins Mellon Arena site in the city of Pittsburgh.

Requirements involved utility infrastructure build-out, including water, sanitary and stormwater collection/conveyance, and coordination with utility providers such as cable, telecommunications, gas, and electric. Additionally, 3D models were developed for design visualization and construction. Relevant utility design guidelines and approvals (water, storm, sanitary) were provided, as per **Pittsburgh Water and Sewer Authority** directives. All work and deliverables were performed in MicroStation format.

Ancillary project work included construction document development for combined sewer separation along Centre Avenue from Crawford Street to Washington Place. This required close coordination with the PWSA and the Sports and Exhibition Authority (SEA) as part of the overall infrastructure development plan. Project constraints included:

- Large initial injected flows from upstream areas to be conveyed through the project site which lies near the bottom of its associated watershed
- Coordination of existing utilities (water, gas, electric, storm, sanitary, and combined sewers) to remain in service and protected during separation
- Coordination with local agencies and residents
- Minimize street closures, trenching, and reconstruction

Primary design and all revisions to pipe network and hydraulic models were reverified as changes were made to ensure network system integrity and conformance across multiple consultants' designs. Full 3D models were developed for visualization and construction, conflict visualization with other utilities and structures. All work and deliverables were provided in MicroStation format.

PINE HOLLOW STORM SEWER ENGINEERING & ENVIRONMENTAL SERVICES

ALLEGHENY, PENNSYLVANIA

Michael Baker
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COMPLETION DATE
2013

COSTS
$1,400,000 (construction)
$665,000 (fee)

MICHAEL BAKER'S ROLE
Hydrologic and hydraulic analysis
E&s control plan development
Utility line verification
Right-of-way acquisition plan development
Wetland identification and delineation
Permit application preparation
Storm sewer alignment design
Traffic control plan development
Construction sequencing plan development
Construction document development
Construction oversight

Michael Baker provided engineering and environmental services for the design of a 60-inch-diameter storm sewer to remove the Pine Hollow Run and Deweyville Run storm flows from the interceptor system.

The scope of work involved construction of a new 5,100-foot-long stream conveyance system, including the storm sewer line, two intake structures, and an outfall structure, to separate the flow of both streams from the Broadway interceptor line. Work entailed environmental investigations and permitting. The project was necessary to meet regulatory commitments for combined sewer overflow control, alleviate periodic basement flooding in area residences, and increase the capacity of the sanitary sewer system.

Michael Baker conducted hydraulic and hydrologic analyses, developed erosion and sedimentation control and right-of-way plans, prepared permit applications, verified utility service line locations, developed the storm sewer line alignment and system design specifications, and prepared traffic control and construction sequencing plans.

Pittsburgh Combined Sewer Overflow History and Regulatory Requirements | Prior to the 1950s, most municipalities in the Pittsburgh region collected storm and sanitary sewer flows in large-diameter combined sewers that ultimately discharged directly into streams or rivers. Little, if any, treatment occurred until construction of the treatment plant and interceptor system in the 1950s. The system was designed to convey and treat up to a set amount of "dry weather" sewer flows. To prevent hydraulic overloading of the interceptor system and treatment plant, any excess flow from storm events was discharged into the receiving waterways as combined sewer overflow.

Over the years, the regulatory environment changed. The collection and discharge of combined sewer flow into waterways is no longer considered within compliance. Municipal sewer system operators are required to search for ways to remove excess stormwater from their systems. Stream inflow points are among the most readily apparent overflow sources — streams within urban areas that long ago were intercepted and diverted into the combined sewer system. These streams often collected runoff from hundreds of acres of tributary area and conveyed tons of sediment and debris with large quantities of stormwater. Because many stream inflow points are located miles upstream of receiving waterways and within densely populated neighborhoods, removal can be particularly challenging.

Pine Hollow and Deweyville Run Stream Removal | The sewer authority negotiated and signed a consent decree on Jan. 23, 2008, that requires the agency to develop and implement a wet-weather control plan to regulate combined sewer overflows by 2026. The consent decree required the sewer authority to perform a group of supplemental environmental projects by Oct. 30, 2011. The sewer authority identified the Pine Hollow stream removal project as a priority supplemental environmental project, along with other stream removal projects. The main goal of the project was to remove Pine Hollow Run and Deweyville Run, located within Kennedy Township, Stowe Township, and McKees Rocks Borough, from the Broadway interceptor and ultimately from the regional collection system.





The removal of these streams will help alleviate chronic basement flooding in the project area and provide additional sanitary sewer capacity in the Broadway interceptor, allowing for future development.

The sewer authority commissioned a preliminary engineering report that conceptually addressed separating the flow contributed by the above-named streams from the Broadway interceptor and conveying it directly to Chartiers Creek. Report recommendations included the construction of a 5,100-foot-long, 60-inch-diameter storm sewer from the intersection of Pine Hollow Road and Broadway Avenue in Kennedy Township to a new outfall along Chartiers Creek near the Windgap Bridge in McKees Rocks.

Michael Baker used the preliminary engineering report as the basis for final design of the stream removal project and performed a final detailed hydraulic analysis to ensure that the 60-inch pipe size would convey the design storm without causing additional flooding concerns. Michael Baker modeled alternate pipe sizes and conducted a cost-benefit analysis. Michael Baker used the latest release of SWMM (Version 5, 2009) to create a systemwide SWMM model that included the Broadway and Deweyville sewers and the proposed stream enclosure pipe on Pine Hollow Road.

Michael Baker applied knowledge gained from experience on similar projects and used its relationships with stakeholders to develop a technically sound and cost-effective solution. The project team's top priority was to locate and verify utilities along the storm sewer alignment. Drawings were prepared that depicted the existing rights-of-way within and along the proposed alignment of the new stream conveyance system. The plan also identified areas of proposed temporary and permanent easement acquisition for construction of the new stream conveyance system. Michael Baker prepared applications and obtained numerous permits. These included NPDES and erosion and sedimentation control permits, a U.S. Army Corps of Engineers (USACE) Chapter 105 permit, and a Pennsylvania Department of Environmental Protection (PADEP) Section 104 joint permit for the stormwater project. Michael Baker investigated and delineated wetlands within the project site and prepared a report. Michael Baker developed plans and cross-sections depicting areas of full and partial roadway reconstruction and plans for traffic control and construction sequencing to minimize construction impacts on communities. Finally, Michael Baker created and updated erosion and sedimentation control plans, construction specifications, and cost and quantity estimates throughout design development.

Michael Baker faced many obstacles in developing the designs for the proposed new storm sewer system, which included routing the system along Pine Hollow Road and Singer Avenue and through a limited amount of private property. Michael Baker overcame these challenges through close coordination with the utility companies; the three affected municipalities; Allegheny County, the owner of Pine Hollow Road; the sewer authority; USACE; PADEP; the Allegheny County Conservation District; and private property owners.

USACE provided federal stimulus money to close funding gaps and ensure that the project could move to construction. The design process was fast tracked to ensure that construction documents would be completed by the spring 2010 construction season so that the project could be awarded, and construction could begin by summer 2010. Michael Baker provided construction oversight to ensure that the project was constructed according to design specifications.

EAST PRINCESS ANNE & NIMMO PARKWAY FORCE MAIN REPLACEMENTS

VIRGINIA BEACH, VIRGINIA

Michael Baker provided engineering services for the replacement of the East Princess Anne and Nimmo Parkway Force Main in Virginia Beach, Virginia. The project consisted of a three-phase design for approximately 13,500 linear feet of 30-inch and 42-inch diameter sewer force main, including a 2,500 linear feet horizontal directionally drilled (HDD) crossing of West Neck Creek, a 650 linear feet HDD crossing of a small stream tributary to West Neck Creek, a 340-foot microtunnel, interconnections to five existing city of Virginia Beach sewage pump stations, and coordination of the proposed force main design with the Nimmo Parkway roadway extension project. This project required extensive stakeholder and permit coordination between construction of the different phases, as well as construction administration and inspection to meet HRSD and VDOT-imposed schedules for design and construction.

Preliminary engineering services include alignment evaluation and pipeline material evaluation. Michael Baker evaluated alternative pipe materials for this project, and the contract documents include steel and ductile iron pipe as alternate bid materials. Other preliminary engineering services include providing necessary survey, easement plats, utility designation and test-hole boring, permitting, and coordination with the Virginia Department of Transportation and the City of Virginia Beach.

Michael Baker prepared design plans and specifications for the force main replacement and provided bidding phase support. The design phase and the first of three construction phases are complete. Michael Baker is providing construction administration and construction inspection.

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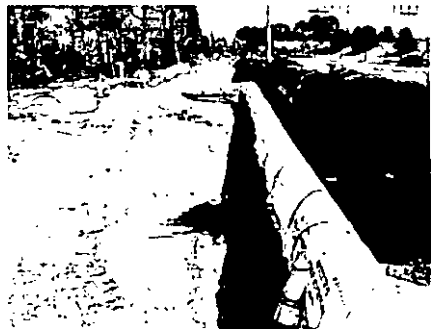
COMPLETION DATE
2014

COSTS
$1,250,000 (fee)

MICHAEL BAKER'S ROLE
Geotechnical investigations
Survey
Traffic control
Bidding services



WARWICK BOULEVARD TO JAMES RIVER INFLUENT FORCE MAIN

VIRGINIA BEACH, VIRGINIA

Michael Baker provided engineering services for the replacement of the Hampton Roads Sanitation District's (HRSD) existing 36-inch flat-bed reinforced concrete influent force main with approximately 4,700 linear feet of 42-inch ductile iron force main along Warwick Boulevard, a four-lane divided highway and primary travel corridor, from Scufflefield Road to Maxwell Lane. Services included survey, design, permitting, geotechnical investigation, corrosion testing, regulatory agency coordination, bidding-phase support, and coordination of design and construction with adjacent force main improvement projects.

The alignment begins in the median of a major city thoroughfare from Scufflefield Road to the Deep Creek tributary crossing. The 42-inch influent force main will cross the Deep Creek tributary west of Warwick Boulevard. The 42-inch influent force main ties in to a connection point in the median at Maxwell Lane.

The scope of work included providing necessary design, permitting, updated survey, test holes, geotechnical investigation, and corrosion testing to initiate construction of the project. Michael Baker coordinated permitting requirements with the city and the Department of Environmental Quality. Significant traffic control was required as part of the design documents. Given the limited space for the pipeline, significant attention to constructability and equipment staging was necessary.

Michael Baker developed plans and specifications in accordance with the district's 2014 standards and preferences. Michael Baker provided bid phase services and construction phase services, including full-time resident inspection.

Due to an emergency repair of the 36-inch force main near Maxwell Lane, the project was divided into two phases to accelerate the design and construction of approximately 2,500 linear feet of the 42-inch force main, including the pump-and-haul plans during shutdown and tie-ins operations for tie-ins to two city pump station force mains and an open-cut crossing of the Deep Creek tributary. Phase I was completed in 2015, while Phase II is nearing completion. In support of the Phase I emergency repairs, Michael Baker expedited the design and bid phase services while supporting design review coordination with the city to meet emergency project needs. Phase II's related work included coordination with HRSD and the city for detailed landscape restoration plan to replace more than 100 trees along the project corridor.

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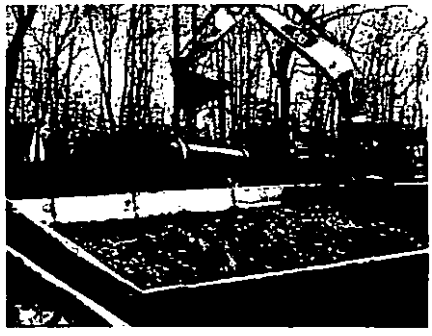
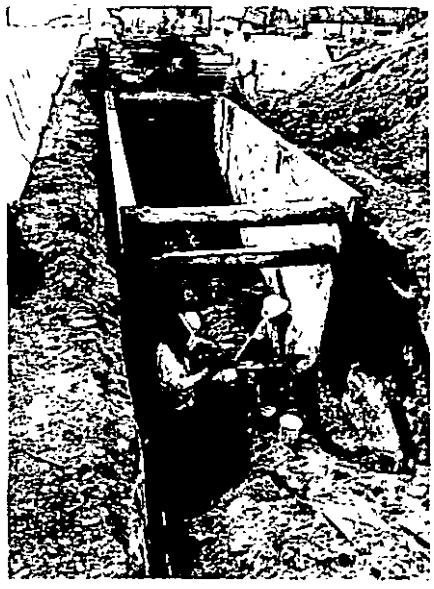
COMPLETION DATE
2018

COSTS
$1,062,700 (fee)

MICHAEL BAKER'S ROLE
Survey
Design
Permitting
Geotechnical investigation
Corrosion testing
Regulatory agency coordination
Bidding-phase support
Construction sequencing





2018 SMALL DIAMETER WATER MAIN REPLACEMENT

PITTSBURGH, PENNSYLVANIA

JMT provided the design of four water mains, approximately 10,000 linear feet total, throughout the city of Pittsburgh ranging from 6-inch to 16-inch to replace aging infrastructure and improve reliability, hydraulic conditions, and water quality. The water mains selected for replacement represent some of the oldest and most critical mains in the PWSA system, including pipelines built in the 1880s and several lead pipes and lead joint service connections.

The water main replacement locations also cover a variety of council districts and land use types, including multipurpose zoning in Homewood, institutional zoning in Bloomfield, commercial/industrial and heavy residential in the Strip District, and residential in Millvale Borough and Shaler Township. The varying land use resulted in an individualized approach to field work, design, and construction planning which includes detailed traffic coordination and uninterruptable water service coordination.

Utility and Key Stakeholder Coordination | JMT completed utility coordination with multiple utilities and local agencies, including PennDOT, Hampton Shaler Water Authority, Borough of Millvale, Allegheny Valley Railroad (AVRR), Peoples Natural Gas, West Penn Hospital, PaDEP, PUC, and Pittsburgh DOMI. Preliminary design services included full subsurface utility engineering (SUE) using a variety of methods to accurately depict existing conditions and challenges to the water main replacement design. Ground penetrating radar was used to locate subsurface water, gas, sanitary, storm, electric, fiber optic, and other buried objects, such as buried abandoned trolley tracks in Hamilton Avenue. Test holes were conducted to determine utility depths, materials, and sizes where accurate drawings were not available. The test holes also allowed for accurate pavement condition review to develop a cost-effective restoration plan. Topographic survey, soil borings, and geotechnical testing were completed to assist with proper water main design. Permitting and public outreach services were coordinated with all key stakeholders to streamline review timelines and review fees while meeting all regulatory requirements.

Special Design Details

- Alignments include the trenchless design of seven jack and bore installations with steel casing pipes underneath the AVRR in the Strip District
- PWSA hydraulic model review for fire flow, testing, restraint, and thrust design
- Preliminary design of new meter vault connection to the 60-inch Lanpher Main
- Material selection and cathodic protection was evaluated for each site individually to account for corrosive soils and stray currents
- Water main profile best practices were instituted to mitigate air pockets, provide the longest design life, and allow for ease of constructability
- Innovative solutions for utility congested roadways were implemented to mitigate easement costs

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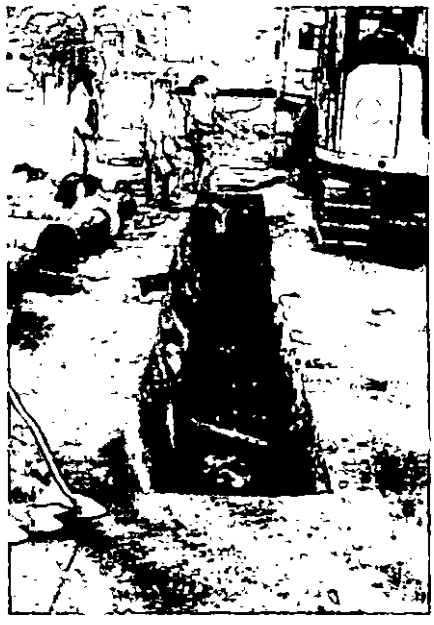
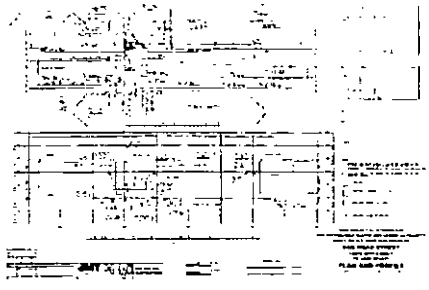
COMPLETION DATE
Ongoing

COSTS
$8,000,000 (estimated construction)
$1,100,000 (fee)

JMT'S ROLE
Preliminary and final water main design
Utility coordination, SUE
Stakeholder and community outreach





REGIONAL SUE UTILITY AGREEMENT

PITTSBURGH, PENNSYLVANIA

JMT is providing Subsurface Utility Engineering (SUE) services, including designation and test holes, to PennDOT Districts 1-0, 10-0, 11-0, and 12-0 for this On-Call Task Order Contract with PennDOT. To date, JMT has been assigned seven work orders. The projects range in scope from major roadway realignments, proposed roundabout design, roadway betterments, and bridge replacements.

Below is a summary of work orders to date:

SR 3101-A10 – Bridge over Jack Run
JMT completed SUE designation and test holes for this bridge replacement project in District 12-0. JMT's crew was able to work dynamically in the field to adjust test hole locations due to challenging soil conditions and located a water line that was estimated to be more than 100 years old.

SR 2075-A05 – Bridge over Pucketa Creek
JMT completed SUE designation for this bridge replacement project in District 11-0. The designation provided allowed PennDOT to determine the extent of utility conflicts, eliminating the need for test holes.

SR 519-K10 – Roadway Realignment
JMT assisted District 12-0 in locating two private service lines that will need to be relocated as part of this roadway realignment project. JMT was able to locate the lines with designation and test holes despite no records and limited information from the owners.

SR 6-S01 – Big-I Roundabout
JMT completed SUE designation and test holes for this proposed roundabout project in District 1-0. More than 15,000 linear feet of designation and 22 test holes were completed.

SR 62-S01 – Roundabout
JMT completed SUE designation and test holes for this proposed roundabout project in District 1-0. JMT was able to deliver more than 26,000 linear feet of designation and 28 test holes in a two-month time frame to meet the District's schedule requirements.

SR 837-A48 – West Carson Betterment Project
JMT performed SUE designation for this roadway betterment project on West Carson Street in District 11-0. This work order is ongoing and is estimated to include 16 test holes.

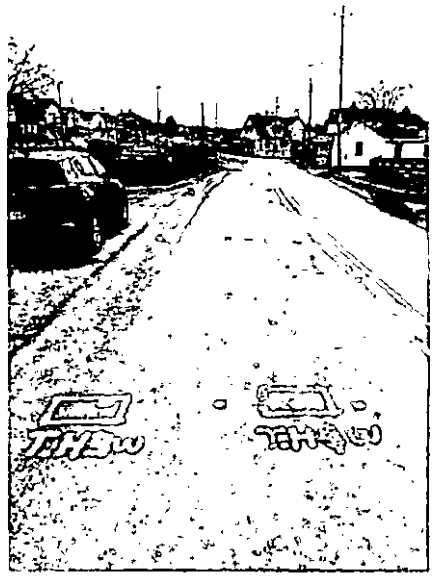
SR 18-B59 – 7th Avenue Betterment Project
JMT is scoped to complete SUE designation and test holes for this roadway betterment project in District 11-0. It is estimated this project will include more than 25,000 linear feet of designation and 31 test holes.

CLIENT
PennDOT
Dina Salemi | 412.429.2899
dsalemi@pa.gov

COMPLETION DATE
Ongoing

COSTS
$2,000,000 (fee)

JMT'S ROLE
SUE designation
SUE test holes
Utility investigation





MUNICIPAL HYRDRAULIC MODELING PROJECTS

NEWARK, DELAWARE

The Department of Public Works (DPW) is responsible for the planning, design, inspection, and operation of the city of Newark's water and wastewater utilities, stormwater management areas, storm sewers, streets, refuse collection, electric utility, and parkland. To accomplish these tasks, the city has hired JMT for two, consecutive on-call contract in which task orders for professional engineering and project management services are issued on an as-needed basis. Representative hydraulic modeling work has included the following projects:

Drinking Water Master Planning, 2015 | The Delaware Water Infrastructure Advisory Council established the Drinking Water Matching Planning Grant (Grant) to support drinking water planning projects throughout the state of Delaware. The city of Newark wanted to develop a prioritized approach to evaluating and replacing their drinking water distribution system to maximize capital expenditures and increase the level of service to over 32,000 customers including the expansive University of Delaware campus. The city requested JMT to prepare a Grant application for the creation of their drinking water GIS database, and create and calibrate a water system hydraulic model. The city received notice of award for the grant project in April 2015.

JMT's Hydraulic Modelers developed a WaterGEMS® Hydraulic Model of the city's Water Distribution system using the GIS Database built under this project. The model was calibrated using field test results (C-Factor Test and Fire-Flow Test) and SCADA Data provided by the city. The hydraulic model includes more than 700,000 linear feet of water mains, seven water towers, five pressure zones, three booster stations, and two water sources, as well as more than 2,400 gate valves and 1,000 fire hydrants. JMT integrated booster station pump curves, operational settings, well production, and water consumption data into the model to simulate daily operating conditions.

JMT used the model to perform simulations of the current system under normal and peak operating conditions, develop scenarios to identify lapses in system delivery pressure and fire flow capacity, and identify critical infrastructure in the system for failure analysis. JMT modeled the failure of critical components within the system, such as storage tanks, reservoirs, and high-pressure service mains, to determine the impact it would have on the water distribution system and develop potential mitigating solutions.

Uni-Directional Flushing Program – Pilot Area, 2018 | The city hired JMT to develop a pilot uni-directional hydrant flushing program for two of the city's pressure zones to improve upon their existing conventional flushing program, targeting higher velocities during flushing events, and to conduct flushing events in a controlled and sequenced manner. To accomplish this, JMT developed the pilot area by determining hydrants that were optimum for flushing with the goal of using a minimum number of hydrants and valve closures. Utilizing WaterGEMS® software, JMT created and sequenced a total of 25 flushing events targeting hydrants in the two pilot area Pressure Zones. QA/QC was completed on the model and the overall program. The program was then implemented in 2018.

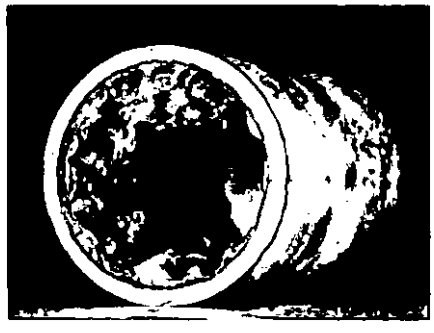
CLIENT
City of Newark, Delaware
Thomas Coleman | 302.366.7000
tcoleman@newark.de.us

DATES
2015-2018

COSTS
$300,000 (Drinking Water Master Planning fee)
$6,900 (Uni-Directional Flushing Program fee)

JMT'S ROLE
Hydraulic modeling
Utility management
Survey services
GIS and database development





I-680 AT SABERCAT ROAD SANITARY SEWER RELOCATION PROJECT

FREMONT, CALIFORNIA

McMillen Jacobs Associates, as a subconsultant, provided geotechnical investigations (e.g., test borings) and tunneling-related/trenchless specifications for the design of the 1,000-foot-long Sabercat replacement sewer in Fremont, California. Additionally, tunneling and geotechnical engineering services were provided during construction.

The completion of the 1,000-foot-long Sabercat sewer is a significant accomplishment for the Union Sanitary District. Most of the district's pipelines are below groundwater and within alluvium. Open-cut construction of the district's pipelines is difficult and costly because of the tendency for the ground to fast-ravel and/or flow. Since the early 1990s, our geotechnical investigations and trenchless recommendations have resulted in the successful completion of many microtunneling projects by the district.

The original Sabercat sewer was a 12-inch-diameter vitrified clay pipeline constructed in the 1960s by open-cut trenching through the former location of Bell Quarry. Fossils from Bell Quarry were used to define the Irvingtonian North American Land Mammal Age (0.3 to 1.8 million years ago), when sabercats lived alongside other now extinct mammals. The ground surface over the alignment has since been occupied by I-680, and the sewer is laterally offset 12 inches where it crosses the Hayward fault.

The replacement sewer was predesigned to be constructed using a microtunnel boring machine (MTBM). However, geotechnical findings led to the final design: a 12-inch-diameter high-density polyethylene (HDPE) carrier pipeline in a 48-inch-diameter steel casing, installed by tunnel boring machine (TBM) via pipe-jacking. In addition to a TBM being more suitable than an MTBM for the geotechnical conditions, the use of a large oversized casing for the carrier pipe allowed the use of a more powerful TBM, made it easier to remove obstructions, increased the magnitude of grade adjustments that could be made, and permitted more accommodation for fault creep. The pipeline was installed parallel to and 20 feet northwest of the original sewer, at depths ranging from about 9 to 50 feet below ground surface.

The tunneling method design change proved beneficial. Large pieces of reinforced concrete were encountered by the TBM beneath I-680. They were hand mined from within the tunnel after temporary removal of the TBM cutterhead.

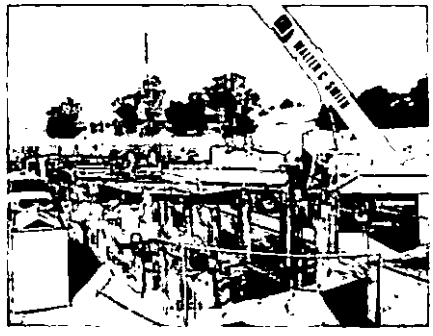
McMILLEN JACOBS ASSOCIATES

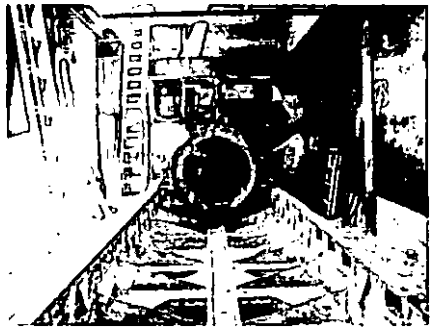
CLIENT
Union Sanitary District
John Goodwin | 530.792.3294
jgoodwin@westyost.com

COMPLETION DATE
2014

COSTS
$1,800,000 (construction)
$10,860 (fee)

MCMILLEN JACOBS' ROLE
Geotechnical investigations
Trenchless specifications
Tunneling and geotechnical engineering services during construction





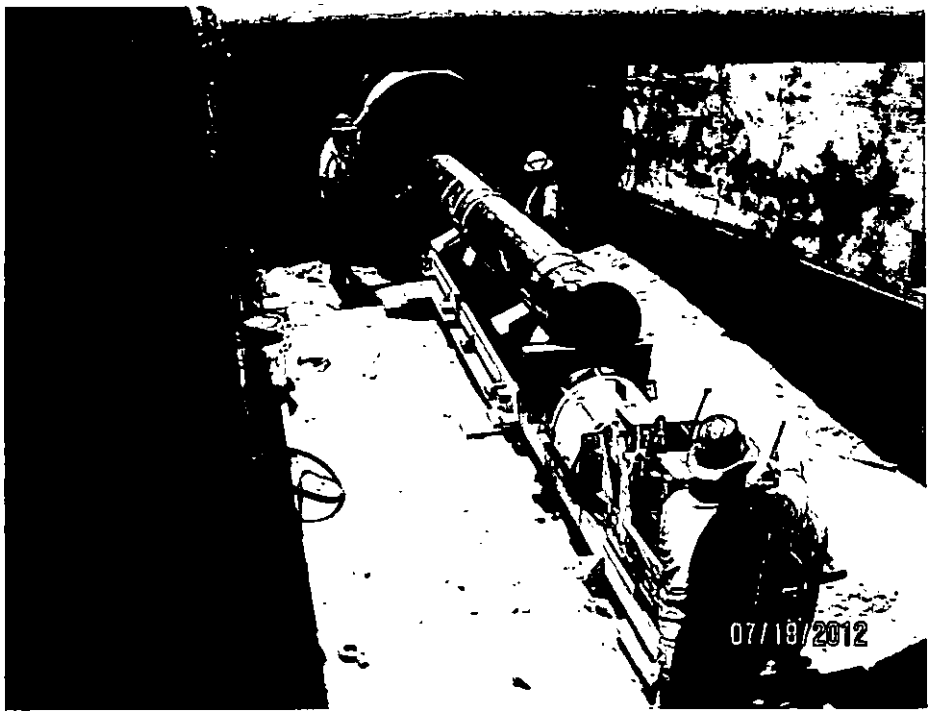
FOOTHILLS TUNNEL (OPHIR ROAD PIPELINES PROJECT)

NEWCASTLE, CALIFORNIA

McMillen Jacobs Associates provided preliminary and final designs for three 60-inch trenchless undercrossings—two parallel crossings beneath I-80, a Caltrans right-of-way (ROW), and one crossing under a Union Pacific Railroad (UPRR) right-of-way. We also provided full-time observations of the two crossings beneath I- 80, which were approximately 240-foot-long parallel drives separated by approximately 10 feet.

The pipelines had about 15 to 20 feet of cover beneath the ROW. The ground conditions were generally granodiorite in various degrees of weathering. The UPRR undercrossing was an approximately 150-foot drive. The pipeline had between 5 and 20 feet of cover. The ground conditions were generally highly fractured metamorphic rock and highly to completely weathered granodiorite residual soil. The two owners of the rights-of-way required steel casings at these depths.

After the original design was undertaken, the vertical alignment of the Caltrans crossing was raised approximately 5 feet, which affected the ground types and properties. The project was completed using a rock-capable small-diameter tunnel boring machine to jack the welded steel casing. A rail-mounted spoils removal system and a muck bucket were used to transport the cuttings out of the tunnel.



McMILLEN JACOBS ASSOCIATES

CLIENT
Placer County Water Agency
Frank Helmick | 530.756.5905
fhelmick@westyost.com

COMPLETION DATE
2015

COSTS
$60,000 (fee)

MCMILLEN JACOBS' ROLE
Trenchless design and inspection services
Preliminary and final design
Construction oversight





CLAIRTON WASTEWATER TREATMENT PLANT EXPANSION

CLAIRTON, PENNSYLVANIA

AE, Inc.

OWNER
Clairton Municipal Authority

CLIENT
KLH Engineers, Inc.
John Mowry | 412.494.0510
jmowry@klhengineers.com

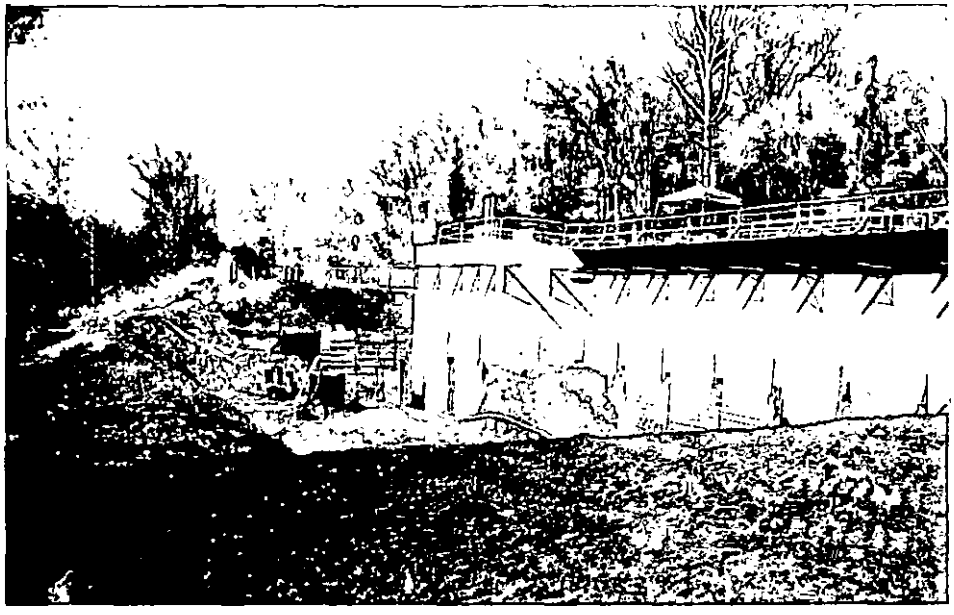
COMPLETION DATE
2018

COSTS
$85,000 (fee)

ACKENHEIL'S ROLE
Subsurface Investigation
Laboratory Testing of Soil and Rock
Geotechnical Engineering Analysis
Report Preparation
Deep Foundation and Shoring Installation Inspection
Materials Testing

Ackenheil Engineers provided geotechnical engineering, inspection and materials testing services for the extensive expansion of the Clairton Wastewater Treatment Plant for the Clairton Municipal Authority. Ackenheil's services included subsurface exploration, laboratory testing of soil and rock, geotechnical analysis for the design of the new structure foundations, preparation of a Geotechnical Investigation report, review of the final plans and specifications, Contractor Shop Drawing review, construction inspection of deep foundation installations and temporary shoring systems, density testing of sewer and water line backfill operations, and concrete testing.

In 2012, the Clairton Municipal Authority needed to extensively expand their treatment facility in the City of Clairton. The expansion included new SBR Tanks, a Sludge Thickener Building, Office Building, Garage, Headworks, Meter Vault and Pump Station. Ackenheil was retained by KLH Engineers to perform a geotechnical investigation for the project to assist in the design of the new structure foundations and underground utilities. The construction of the project began in 2016 and was just completed in the summer of 2018. Ackenheil was also retained to review the final plans and specifications for conformance to our recommendations, to review the Contractor Shop Drawings, to provide construction inspection services during foundation and utility installations and to provide materials testing services.





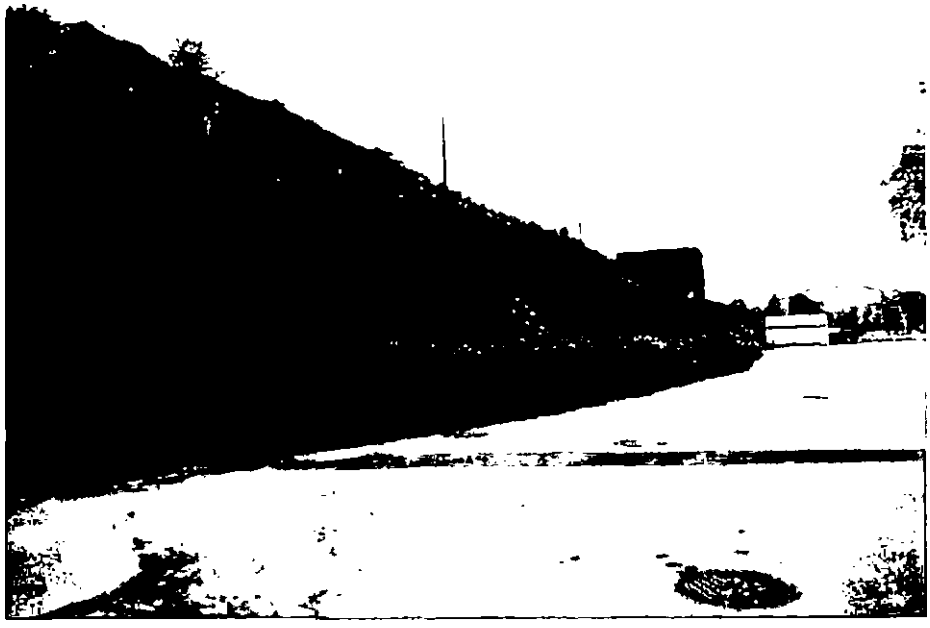


LANPHER RESERVOIR REHABILITATION

PITTSBURGH, PENNSYLVANIA

awk CONSULTING ENGINEERS, INC.

This project consists of the civil/structural design to provide rehabilitation of deteriorated portions of concrete slopes and reservoir panels, concrete walkways, concrete parapets, retaining walls, and structural elements of Gate House Structure, design of a new Sodium Hypochlorite Storage Building and new flow meter vault involving inspection and assessment, preparation of structural repair contract plans, specifications, and cost estimate, bid support, and consultation during construction. Additionally, geotechnical engineering services are being provided to assess and design subsurface conditions at the anticipated locations of the proposed vault and building and assess the stability of the northern reservoir slope.



OWNER
Pittsburgh Water & Sewer Authority

CLIENT
Arcadis
Ron Ciucci | 724.934.9544
Ronald.ciucci@arcadis.com

COMPLETION DATE
Ongoing

COSTS
$242,815 (fee)

AWK'S ROLE
Surveying
Right-of-way Study
Utility Coordination Services
Civil/Structural and Geotechnical Engineering & Design Services

WET WEATHER PLANNING AND PUBLIC INVOLVEMENT

PITTSBURGH, PENNSYLVANIA

Karen Brean began the firm's wet weather work in 2006 as a subconsultant on the Chester/Metcalf and Eddy team undertaking the Overflow Control Facilities Demonstration Project. From 2008 through 2011, Karen was a member of four Basin Facilities Planning teams - Main Rivers, Upper Allegheny/Pine Creek, Lower Ohio/Girty's Run, and Turtle Creek. As the public involvement lead for those Basin teams, in addition to staffing the Basin Committee and public meetings, Karen prepared:

- Public participation plans to outline procedures to be used;
- Stakeholder databases, including elected and appointed municipal officials, basin planning committee members, and local stakeholders; and
- Quarterly activity reports, detailing key basin activities including technical studies and issues, basin planning overviews, wet weather program updates, and public participation activities.

From September 2011 through December 2012, Karen Brean led a team supporting ALCOSAN's public participation efforts around the release of the Draft Wet Weather Plan. In addition to convening public meetings and public officials' briefings throughout the service area, the public involvement team coordinated key advisory groups on technical and outreach issues, including seven Basin Planning Committees, the Customer Municipality Advisory Group, and the Regional Stakeholders Group. In addition, the team assisted in convening media conferences and public officials' briefings.

During 2012 and 2013, the firm worked on the AECOM team staffing the efforts of the Sewer Regionalization Review Panel. The Panel's report highlighted the position that collaboration and integration of those involved in wastewater management would result in better water quality.

CLIENT
ALCOSAN
Arletta Williams | 412.766.4810
Arleta.williams@alcosan.org

COMPLETION DATE
2013

COSTS
$225,000 (fee for Wet Weather Release)

BREAN ASSOCIATES' ROLE
Public Involvement Task Lead

2018 SEWER RECONSTRUCTION PROJECTS

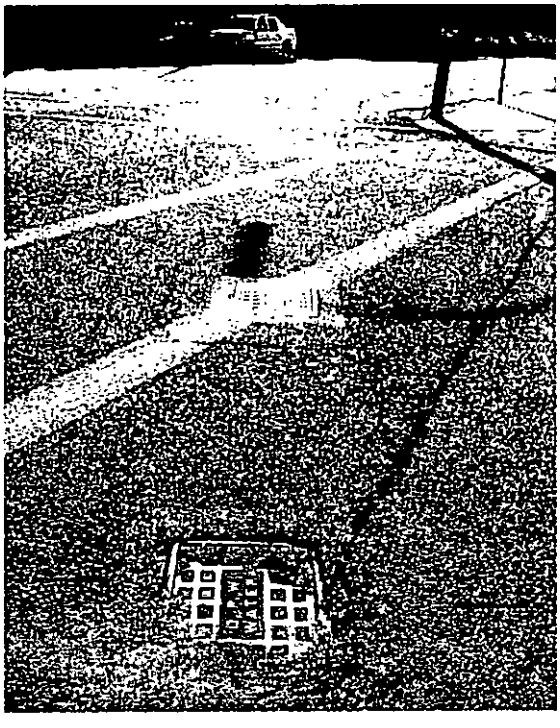
PITTSBURGH, PENNSYLVANIA

To address concerns with the aging infrastructure, the PWSA 2018 SEWER Reconstruction Projects includes the design of four separate water main replacements in the PWSA system.

The following mains will be replaced:

- Hamilton Avenue from N. Dallas Avenue to N. Homewood Avenue
- Railroad Street from 25th Street to 32nd Street
  - Includes multiple railroad crossings
- S. Millvale Avenue from Liberty Avenue to Friendship Avenue, Friendship Avenue from S. Millvale Avenue to Gross Street, Gross Street from Friendship Avenue to Friendship Avenue
- Millvale Borough

MBE has completed the topographic and utility survey and establishment of the alignment and legal right-of-way for all four sites.



mbe monaloh basin engineers

OWNER
Pittsburgh Water & Sewer Authority

CLIENT
JMT
Mallory Griffin, PE | 412.375.5116
mgriffin@jmt.com

COMPLETION DATE
Ongoing

COSTS
$90,000

MONALOH'S ROLE
Topographic surveys for multiple sites
SUE location on each site
Roadway Research
Established existing alignments
Established Legal Right-of-Way Lines

31ST WARD SEWER SYSTEM IMPROVEMENTS PROJECT

PITTSBURGH, PENNSYLVANIA

Sci-Tek provided professional engineering, surveying, and consulting services for proposed site facility infrastructure within the 31st Ward on behalf of the **Pittsburgh Water and Sewer Authority (PWSA)**. The PWSA currently owns and operates two sanitary sewer pump stations that convey flows from the 31st Ward sewershed to the Streets Run Sanitary Trunk Sewer. Both sewage pump stations and force mains were constructed in the late 1940s and have experienced an increase in failures in recent years. Additionally, the PWSA desires to reduce the amount of infiltration/inflow entering the system. Sci-Tek's scope of work for this project includes the following tasks:

Task 1 | Geotechnical Engineering

For this task, Sci-Tek:

- Drilled test borings for soil characterization and piezometer installation.
- Selected representative samples of the material recovered for laboratory testing of physical properties.
- Developed Engineer's Logs of the subsurface data obtained using gINT software by Bentley.
- Provided geotechnical engineering recommendations to support the design of proposed infrastructure.
- Collected water level data in the field.

Task 2 | Surveying and Field Investigation

For this task, we provided the following:

- Topographic Survey
  - Field survey and topographic survey of the existing site conditions and PA One Call System markings
- Manhole Survey
  - Horizontal locations and vertical elevations of approximately 50 manhole rims
  - Documentation of state plane coordinates and elevation data collected on the manholes
  - Field investigation and internal inspection of manholes

Task 3 | SITE EVALUATION OF SEWER FLOW MONITORING SITES

For this task, we provided the following:

- Site evaluations of three potential flow monitoring sites.
- Completion of a site evaluation forms including details on site location, sketch of location and flow in the manhole, hydraulic conditions, flow measurements, access and safety conditions, debris, evidence of surcharge, and flow conditions

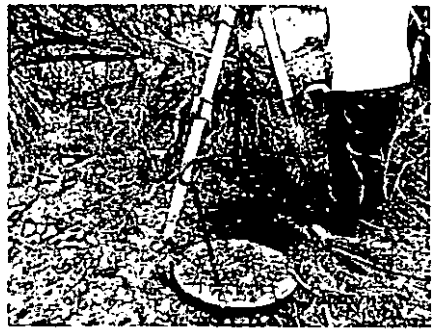
Sci-Tek Consultants, Inc.

CLIENT
Buchart Horn Inc.
Gregory Scott | 412.567.2235
gscott@bucharthorn.com

COMPLETION DATE
Ongoing

COSTS
$121,550 (fee)

SCI-TEK'S ROLE
Geotechnical engineering
Surveying and field investigation
Site evaluation of sewer flow monitoring sites





LANPHER RESERVOIR | SODIUM HYPOCHLORITE AND HVAC SYSTEMS

PITTSBURGH, PENNSYLVANIA

Cosmos Technologies, Inc. (Cosmos) is providing the design of a complete, new HVAC for installations and plumbing system for the sodium hypochlorite system of the Pittsburgh Water and Sewer Authority's Lanpher Reservoir.

The existing system is in poor condition, and the ventilation and heating systems are non-functional.

To date, Cosmos has performed the Basis of Design report and supervised the computer-aided design and drafting (CADD) work for the 60% deliverable. The new design follows the Ten States Standard for water treatment facilities as well as all other relevant regulations.

Preliminary and Final Design of a new sodium hypochlorite system including plumbing and HVAC components consider sizing material, material compatibility, safety, and constructability.

Preliminary drawings are provided in AutoCAD for conversion to MicroStation upon final delivery.

Upon completion, Cosmos will perform a final Inspection and commissioning.

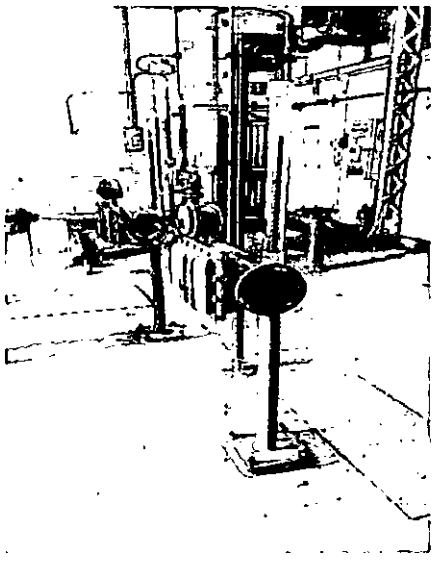
OWNER
Pittsburgh Water and Sewer Authority

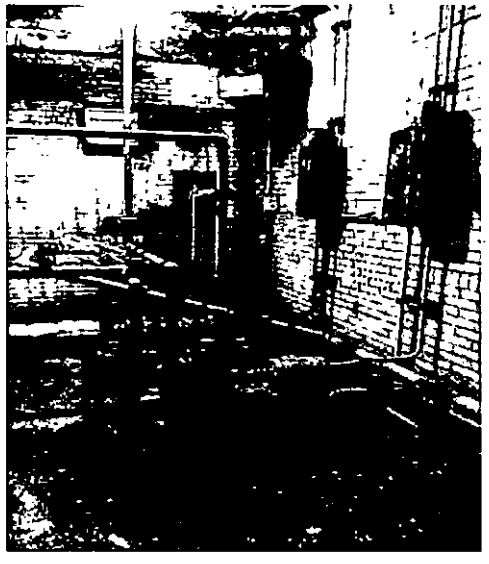
CLIENT
Arcadis
Ron Ciucci | 724.934.9544
Ronald.ciucci@arcadis.com

COMPLETION DATE
Ongoing

COSTS
$104,000 (fee)







ADDITIONAL RELEVANT PROJECT EXPERIENCE

FOX CHAPEL PUMP STATION & RISING MAIN

PITTSBURGH, PENNSYLVANIA

Michael Baker INTERNATIONAL

Michael Baker performed preliminary and final design engineering for a new potable water pump station and transmission main to supply 5,500,000 gallons of water per day to the Fox Chapel Water Authority.

The project began with a preliminary design phase during which an extensive study was performed to determine the most cost-effective way to supply the 5.5 MGD required under the contract. A hydraulic model of the system was developed, and several options were considered to determine how to most efficiently supply the Fox Chapel Authority demands, which peaked during the daylight hours, while simultaneously taking advantage of the lower electric rates available for pumping during nighttime hours. Michael Baker presented several potential pump station configurations that allowed for efficient, yet flexible pump operation. A concurrent study took place to determine the most feasible route for the transmission main that would take the water from the Aspinwall Pump Station to the supply point in Fox Chapel.

Following the preliminary design phase, the decision was made to use three centrifugal pumps rated at 2400 GPM at 375 TDH installed in parallel to provide the required 5.5 MGD at 419 TDH from the primary water supply source. A fourth pump, drawing water from a secondary supply source, would provide up to 1800 GPM at 588 TDH. Michael Baker proceeded with the design of the system, which included retrofitting the new pump station within the lower level of the Aspinwall Pump Station building. An advance contract provided for the installation of an access hatch and overhead crane and runway system in the basement so that the massive pumps, motors, valves, and piping could be handled by the pump station contractor. An additional advance contract allowed the client to procure the major pump station mechanical and electrical components.

To power the 300 horsepower pump motors, a new transformer, switchgear, and motor control center were designed and integrated into the existing pump station. Modifications to the SCADA system were designed so that the new pumps could be controlled from the plant's master control center and the water level in the Fox Chapel system tank monitored. Concurrent with the pump station design, plans and specifications were prepared for the waterline contract that contained 7,000 lineal feet of 16-inch diameter ductile iron pipe. A portion of the route was bored under and installed within a busy Norfolk Southern right-of-way along Freeport Road. The route passed through three communities and tied into the existing Fox Chapel system via a new meter vault constructed at Rockwood Drive. The route was designed to minimize impact to a public park and residential properties in Fox Chapel.

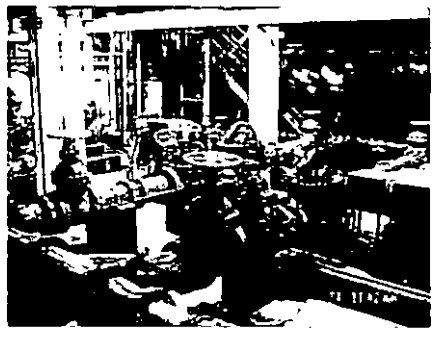
CLIENT
Pittsburgh Water and Sewer Authority

COMPLETION DATE
2004

COSTS
$2,000,000 (construction)
$328,5000 (fee)

MICHAEL BAKER'S ROLE
Study and planning water system demand
Design of water system improvements
Retrofit of existing pump station with new pump and appurtenances
Construction phase services
Transmission main route study
Hydraulic modeling & analysis
Electrical demand analysis
Pump station design
Transmission main design
Electrical engineering & SCADA design
Permitting & easement
Facility start-up services





HILLTOP-POINT O'WOODS FORCE MAIN REPLACEMENTS

VIRGINIA BEACH, VIRGINIA

Michael Baker provided engineering services for the replacement of the Hilltop/Point O' Woods Force Main in Virginia Beach, Virginia. The project consisted of the design of approximately 14,500 linear feet of 42-inch force main, three major road crossings using tunnel boring machines, five interconnections with existing city of Virginia Beach pump stations and existing infrastructure via extensive sequencing, and flow control plans (including a 42-inch linestop with bypass). This project included significant coordination with the City Public Works staff as the alignment was designed along the heavily traveled urban corridor of Laskin Road. Significant traffic control restrictions were required, including a large portion of the project being constructed at night. Also included in this project was the relocation of city water mains to provide a more favorable force main alignment. Michael Baker developed contract documents to allow bids on each phase, or as one combined project.

Preliminary engineering services included alignment evaluation and pipeline material evaluation. Michael Baker evaluated alternative pipe materials for this project, and the contract documents included steel and ductile iron pipe as alternate bid materials. Additionally, Michael Baker evaluated the appropriateness of using T-lock-lined prestressed concrete cylinder pipe. Other preliminary engineering services included providing necessary survey, easement plats, utility designation and test-hole boring, permitting, and coordination with the Virginia Department of Transportation and the city of Virginia Beach.

Michael Baker prepared design plans and specifications for the project and provided bidding-phase support. During the bidding process, Michael Baker separated the project into two phases and allowed bidders to submit proposals for either the entire project or for one of the two phases. This innovative approach encouraged participation by smaller, local contractors to minimize construction costs.

Michael Baker also provided contract administration services and inspection services, startup and testing, and post-startup and certification services. These services included conducting the preconstruction conference; schedule monitoring; shop drawing review; review and approval of laboratory, mill, and shop tests; responses to contractor requests for information; change order review; and review and approval of contractor progress payments. Inspection responsibilities included specialized mechanical, electrical, instrumentation, and control inspections; quality assurance inspections; and final inspection, punch-list preparation, and warranty period establishment.

Michael Baker
INTERNATIONAL

CLIENT
Hampton Roads Sanitation District

COMPLETION DATE
2011

COSTS
$1,200,000 (fee)

MICHAEL BAKER'S ROLE
Geotechnical investigations
Survey
Traffic control
Bidding services



PUMP STATION 27 SERVICE AREA WATER AND SEWER REHABILITATION AND REPLACEMENT

NORFOLK, VIRGINIA

Michael Baker provided engineering services for the rehabilitation or replacement of the water and sanitary sewer infrastructure within the city's service area 027, which consists of Pumping Station No. 27, approximately 88,000 linear feet of 8- to 16-inch gravity sewer mains, and more than 276 manholes. Michael Baker's services included data collection and field investigations, preliminary engineering, design, and construction administration.

Preliminary Engineering Services | Michael Baker's preliminary engineering services included reviewing as-building information and maintenance history and conducting field investigations to evaluate collection system deficiencies and challenges, including inaccessible backyard sewers, inadequate pipe slopes, and inflow and infiltration concerns. Michael Baker prepared a preliminary engineering report.

Service Area System Improvements | The preliminary engineering report recommended that Service Area 027 be divided into two smaller service areas, 027 and 150, requiring installation of a new sanitary sewer collection system, including water distribution system improvements, plus construction of new pump station No. 150 and replacement of the original pump station No. 27 and corresponding force mains, to ensure adequate gravity system coverage with proper slopes and pipe sizes. Design and construction of the new western Service Area 150 system improvements was separated into 10 phases to be designed and constructed over a multiyear period, followed by replacement of the eastern service area under a similar future multiphase, multiyear plan.

Phase 1—Pump Station 150 Design | Due to the existing gravity system's pipe size, depth, and slope constraints, a new pump station was required to serve the newly defined Service Area 150. Michael Baker completed the design of a 1.5-million-gallon-per-day wet well-dry well sanitary sewer pump station and 130 linear feet of 8-inch on-site force main. Design of the pump station required coordination with the public works and parks and recreation departments to identify a new pump station location.

Phase 2—Gravity System Replacement | Michael Baker completed the design of approximately 4,800 linear feet of 8- to 12-inch gravity main and 88 service connections, including 4,300 linear feet of private laterals and 1,200 linear feet of 8-inch force main connecting with the Hampton Roads Sanitation District's 20-inch interceptor force main. A significant portion of the sewers that were replaced involved the abandonment of 8-inch collection mains behind single family homes. As a result, Michael Baker was required to investigate each house to determine how to redirect the sanitary laterals to the new sewers in the public right-of-way in front of the houses.

Phases 3, 4, and 5—Gravity Sewer System Replacement | Michael Baker subsequently designed this next phase of gravity sewer replacement, consisting of approximately 1,200 linear feet of new 8-inch gravity sewer and 31 service connections as Phase 3. Michael Baker then designed approximately 2,900 linear feet of new 8-inch gravity main and 75 service connections as Phase 4. For Phase 5, Michael Baker designed approximately 3,200

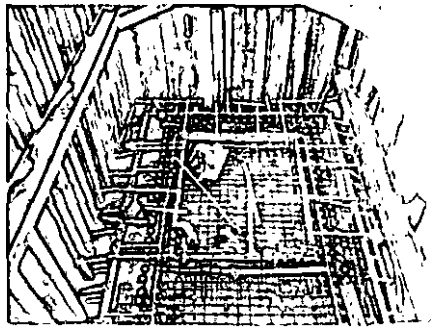
Michael Baker INTERNATIONAL

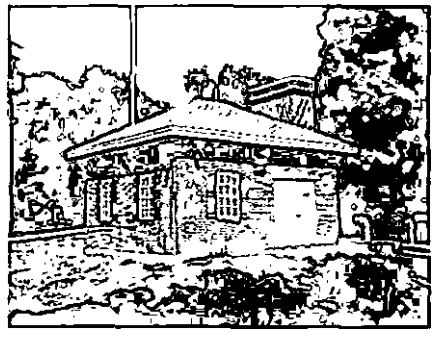
CLIENT
City of Norfolk, Virginia

COMPLETION DATE
2019

COSTS
$11,563,000 (fee)

MICHAEL BAKER'S ROLE
Data collection
Field investigations
Preliminary engineering report
Design services





linear feet of 8-inch new gravity main and 85 service connections, including milling and resurfacing neighborhood streets down to original gutter pan depth to improve stormwater flow during rain events.

Phase 6—Pump Station 27 Replacement | Michael Baker designed a new 3,400 GPM wet well/dry well pump station to replace the City's existing Pump Station No. 27 on an adjacent site. Design tasks included geotechnical investigations, environmental site assessment, on-site linestop and temporary bypass piping (to maintain operation of the existing ump station during construction), allocation of Virginia Revolving Loan Fund (VRLF) resources, evaluation of new innovative pump station design features (self-cleaning bar screen, baffle wall in wet well, photoionization odor control technology), minimizing depths of upstream replacement gravity sewer, and potential additional pump stations in the re-configured collection system service area.

HOLLAND ROAD FORCE MAIN CORRIDOR EVALUATION

SUFFOLK, VIRGINIA

Michael Baker
INTERNATIONAL

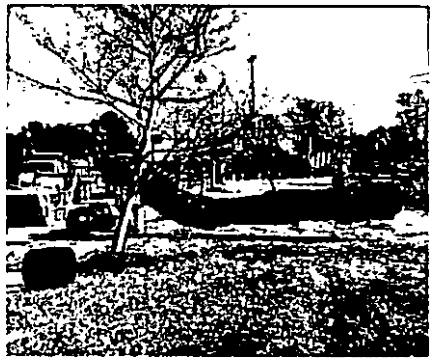
CLIENT
Hampton Roads Sanitation District

COMPLETION DATE
2018

COSTS
$1,200,000 (fee)

MICHAEL BAKER'S ROLE
Geotechnical investigations
Survey
Traffic control
Bidding services

The Holland Road 24-inch Interceptor Force Main Section A project includes the replacement of the Hampton Roads Sanitation District's (HRSD's) existing 10- through 20-inch force mains with a proposed 24-inch force main, traversing through portions of rural, residential, commercial, former railroad right-of-way and historic downtown areas of Suffolk. Michael Baker has provided preliminary engineering, design, construction administration and inspection services for installing approximately 26,000 LF of proposed 24-inch force main, including a 3,200 LF horizontal directional drill (HDD) crossing of a raw water reservoir owned by another municipality (Portsmouth), as well as nine (9) trenchless crossings of 18- to 48-inch steel casing installations under railroads, highways and wetlands using microtunneling, tunnel boring method (TBM), and jack-and-bore techniques. In addition, the project also includes approximately 4,900 LF of 6- to 16-inch sewer force main associated with (re)connections to six City pump stations, and approximately 6,000 LF of 6- to 12-inch water main water system improvements in the residential area of the project corridor. The project is being constructed in two phases.



The scope of services included a route study of pipeline alignment alternatives, survey, cultural resources investigation, wetlands delineation, design, environmental and railroad permitting, test holes, geotechnical investigations, traffic control and corrosion testing. Related work included coordination with HRSD, the cities of Suffolk and Portsmouth, multiple regulatory agencies and two railroad companies concerning key project features, including: line-stop/bypass pumping operations and sewage pump-and-haul plans during shutdown and tie-ins operations to the interceptor and City force mains; raw water reservoir and railroad crossings; modifications to an existing pedestrian bridge, and construction of two miles of temporary construction access road. Tie-in planning activities involved review of Tie-in Checklists and coordination of pump-and-haul operations for 15 City of Suffolk and 11 private pump stations during each phase/project.

LUCAS CREEK WOODHAVEN INTERCEPTOR FORCE MAIN REPLACEMENT PHASE I

NEWPORTS NEWS, VIRGINIA

Michael Baker provided engineering services for the replacement of the Lucas Creek Woodhaven interceptor force main. Michael Baker's services included the preparation of preliminary engineering report, final design, bidding-phase support, and construction administration and inspection.

The project involved the replacement of approximately 5,400 linear feet of 24-inch ductile iron interceptor force main with equivalent diameter ductile iron pipe along Warwick Boulevard, from the intersection of Thorncliff Drive to Lucas Creek Road. The existing 24-inch ductile iron pipe was experiencing internal corrosion due to the composition of the waste stream.

Michael Baker conducted a corridor analysis of alternative alignments along this four-lane divided highway and primary travel corridor to evaluate constructability and impacts to the public, including traffic, neighborhood and business access, proposed development, and accessibility for future maintenance. Design features included detailed sequence of construction and pump-and-haul plans to facilitate optional two-directional flow to the James River and Williamsburg treatment plants and shutdown and tie-in operations for phased interceptor system interconnections for reconnections of five City of Newport News and private pump stations.

Related work included coordination with sanitation district, the Virginia Department of Transportation (VDOT) and the city, and associated traffic control, easements, compliance with Virginia Revolving Loan Fund requirements, intersecting VDOT Atkinson Boulevard improvements, and a detailed landscape restoration plan to replace more than 100 trees along the project corridor.



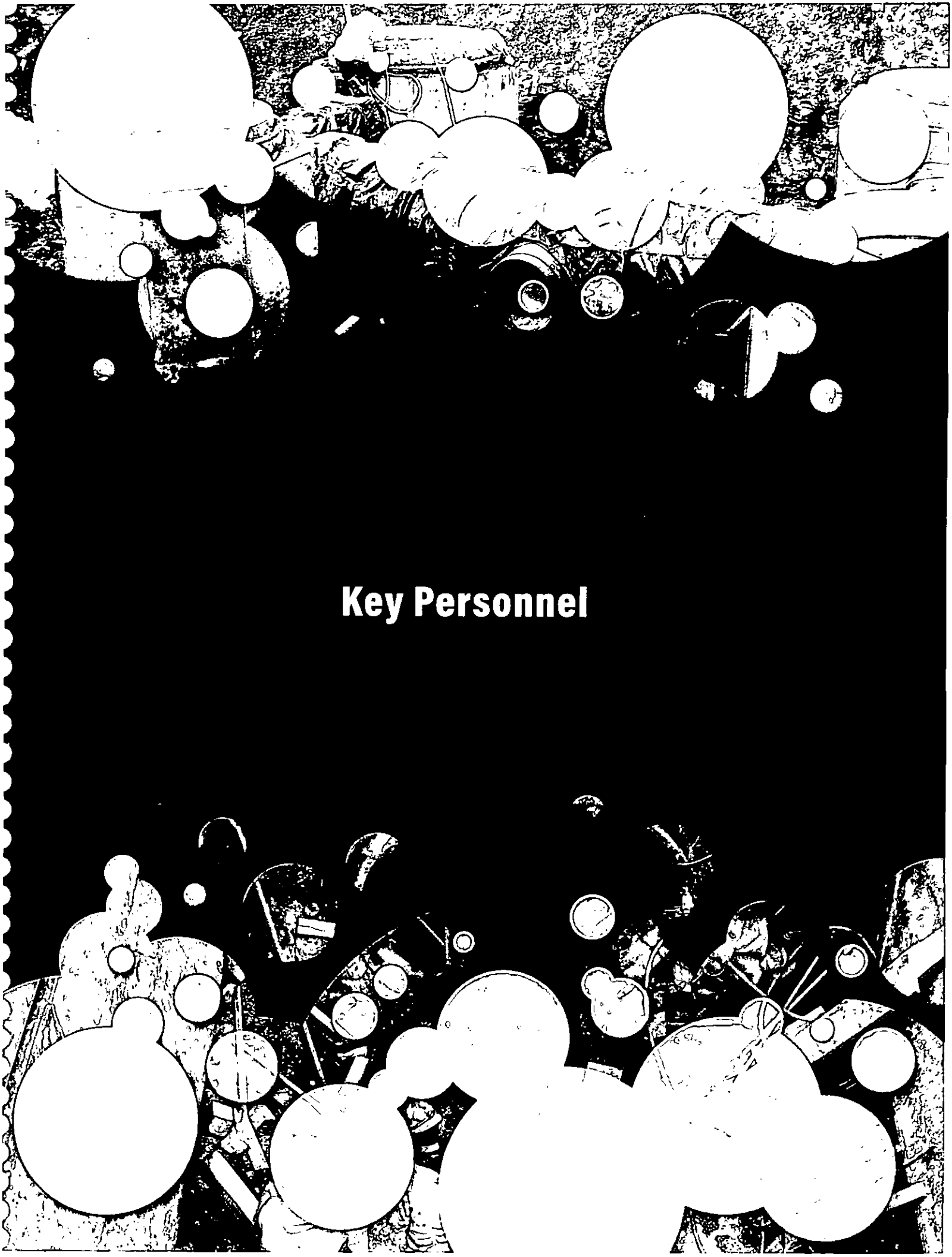
Michael Baker
INTERNATIONAL

CLIENT
Hampton Roads Sanitation District

COMPLETION DATE
2019

COSTS
$3,500,000 (construction)
$911,000 (fee)

MICHAEL BAKER'S ROLE
Preliminary and final design
Bidding-phase support
Construction administration
Construction inspection



Key Personnel

SECTION 5: KEY PERSONNEL

DIFFERENTIATOR

UNPARALLELED PROJECT TEAM EXPERIENCE WITH UTILITY RELOCATION DESIGN IN THE PROPOSED PROJECT AREA

PGH2O

PRINCIPAL-IN-CHARGE
Fred Muncy, PE

PROJECT MANAGER
Brad Duda, PE ✪

QA/QC
Mallory Griffin PE JMT ✪

PRELIMINARY DESIGN REPORT
Charles Maher, PE ✪ (Lead)

ROUTE EVALUATIONS
Charles Maher, PE ✪
Sridhar Aluguvelli, PE, PMP, CFM ✪
Wendy Berrill, PE ✪
John Lasko, PG ✪

DESKTOP ANALYSIS
Brad Duda, PE ✪

WORKSHOPS
Heather Dodson, PE, LEED AP ✪
Karen Brean KBA

PRELIMINARY DESIGN REPORT
Charles Maher, PE ✪
Brad Duda, PE ✪
Sridhar Aluguvelli, PE, PMP, CFM ✪

FINAL DESIGN & PERMITTING
Jeff Frye, PE ✪ (Lead)

SURVEY
Brody Tunno, PLS MBE

SUE
Douglas Bock JMT ✪

PIPE MATERIALS & CLASS
Charles Maher, PE ✪
Mallory Griffin PE JMT

PLANS AND DETAILS
Charles Maher, PE ✪
Don Gregor, PE ✪
Brian Baker, PE ✪

COST ESTIMATING
Kenneth Crawford, PE ESA

PHASE 1 EA
Jason Baguet, PE STC
Kim Bartos, PWS, CE ✪

TRAFFIC DESIGN
Steve Stuart, PE, PTOE ✪

GEOTECHNICAL ENGINEERING
John Lasko, PG ✪
Burton Holt, PE ACK
Vaibhav Swami, PE AWK

TUNNEL DESIGN
Tennyson Muindi, PE MJA ✪

CONSTRUCTABILITY REVIEWS
David Cameron

MEETINGS
Brad Duda, PE
Jeff Frye, PE
Charles Maher, PE

CCTV
Sridhar Aluguvelli, PE, PMP, CFM ✪
Gary Kirby RPC

REGULATORY ENGAGEMENT/ PERMITTING
Kim Bartos, PWS, CE ✪
Sridhar Aluguvelli, PE, PMP, CFM ✪
Heather Dodson, PE, LEED AP ✪
Wendy Berrill, PE ✪

UTILITY COORDINATION
Brad Duda, PE ✪

TRAFFIC CONTROL PLANS
Steve Stuart, PE, PTOE ✪

EASEMENTS
Brody Tunno, PLS MBE

MUNICIPAL/COMMUNITY ENGAGEMENT
Peter Quintanilla ✪
Karen Brean KBA

BID PHASE SERVICES
Charles Maher, PE ✪ (Lead)
David Cameron
Jeff Frye, PE ✪

CONSTRUCTION PHASE SERVICES
Jeff Frye, PE ✪ (Lead)
Brad Duda, PE ✪
David Cameron

SUPPORT SERVICES
Fred Muncy, PE
Scott Quast, PE

✪ Denotes key personnel (resumes provided)

JMT Johnson, Mirmiran & Thompson
MJA McMillen Jacobs Associates
ESA Executive Solutions Associates | SDVOSB
ACK Ackenheil Engineers, Inc. | MBE
AWK AWK Consulting Engineers, Inc. | MBE
KBA Brean Associates | WBE
MBE Monaloh Basin Engineers | WBE
COS Cosmos Technologies Inc. | MBE
RPC Robinson Pipe Cleaning | WBE
STC Sci-Tek Consultants, Inc. | MBE

KEY STAFF	% ALLOCATED TO PROJECT	KEY STAFF	% ALLOCATED TO PROJECT
Brad Duda, PE	70%	Heather Dodson, PE, LEED AP	10%
Charles Maher, PE	60%	Don Gregor, PE	50%
Jeff Frye, PE	40%	Brian Baker, PE	50%
Sridhar Aluguvelli, PE, PMP, CFM	25%	Kim Bartos, PWS, CE	10%
Wendy Berrill, PE	15%	Steve Stuart, PE, PTOE	15%
John Lasko, PG	35%	Peter Quintanilla	5%

All key personnel are located in our Moon Township, PA office.

BRAD DUDA, PE
PROJECT MANAGER

Brad is Senior Technical Manager with nearly three decades of experience on water system projects in the City of Pittsburgh and Allegheny County. Projects have included testing and analysis of existing water distribution systems, valve and meter vault designs, pump station modeling and piping design, distribution system upgrades, large diameter (60") water transmission main design. Responsible for preparation of contract documents for water system improvement projects including plans, details, specifications, cost estimates and permits. Experienced with construction phase services and oversight of inspection related to water system construction.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 28
YEARS WITH MICHAEL BAKER: 28

TIME ALLOCATED: 70%
OFFICE LOCATION: Moon Township

DEGREES
- BS, 1989, Civil Engineering, Point Park University

LICENSES/CERTIFICATIONS
- Professional Engineer, Pennsylvania

Fox Chapel Pump Station and Rising Main, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. As Engineer for waterline design responsibilities included field reconnaissance, survey coordination, right-of-way research, railroad occupancy permitting, plan drawing preparation and specification writing. Pump station design responsibilities included hydraulic analysis of the proposed system, pump and motor selection, layout of the pump station piping and appurtenances, coordination of electrical design, and plan drawing and specification preparation.

North Shore Riverfront Park, Pittsburgh, Pennsylvania. Sports and Exhibition Authority of Pittsburgh and Allegheny County. Engineer responsible for engineering support for the design and construction of the new riverfront park. Primary design responsibilities included modifications to existing storm sewer outfalls, a new water distribution system and miscellaneous utility relocations. Coordinated with stadium architects and engineering consultants where the new park adjoined their facilities. Worked extensively with marine engineering consultants and landscape architects on the new shoreline and riverfront bulkhead wall, and prepared permit drawings for shoreline revisions. Performed extensive research of existing utilities and analysis of the impact of vacating existing streets and changing the Ohio River shoreline for conversion into a park. Coordinated new and relocation work with the City of Pittsburgh, the *Pittsburgh Water and Sewer Authority*, Allegheny County Health Department, ALCOSAN, Duquesne Light Co. and other utilities. Prepared and submitted permit drawings for Pittsburgh Water and Sewer Authority approvals. Deliverables included plans, profiles, details, and cost estimates.

Garfield Heights Housing Redevelopment Phase I Site Design, Civil Engineering, and Construction Phase Services, Pittsburgh, Pennsylvania. Urban Redevelopment Authority. Engineer responsible for the design of new public infrastructure in conjunction with the redevelopment of a former public housing project site into ninety (90) housing units. Project scope included: preliminary investigations of existing utility systems; development of plans for repairs and upgrades to water and sewer facilities owned by the *Pittsburgh Water and Sewer Authority*; coordination with private developer's extensive site work; design of new roadways, drainage, curbs, ADA ramps and signage for the City of Pittsburgh streets; design of resurfacing plans for adjacent City streets; and coordination of street lighting design, maintenance and protection of traffic plans, and landscape plans. Prepared construction plans and specifications in accordance with City of Pittsburgh and PennDOT standards for bidding by the URA. Following award of construction contract, provided construction phase consultation for the duration of the project.

S.R. 28, East Ohio Street Improvement Project, Allegheny County, Pennsylvania. Pennsylvania Department of Transportation, District 11-0. Technical Manager responsible for the design of utility replacement and relocation as part of the overall roadway, bridge, and railroad reconstruction project. Managed field reconnaissance activities for the location, mapping, and assessment of the existing utility systems including water, sewer, electric, telephone, fiber optic cable, and natural gas. Developed plans for vacuum assisted subsurface utility location services as well as CCTV pipe inspection and manhole analysis. Coordinated with all affected utilities to develop plans for the relocation and/or replacement of their respective facilities. Worked closely with the *Pittsburgh Water and Sewer Authority* engineering department to analyze the impacts of the project on their water and sewer systems. Developed comprehensive sewer improvement plans that work in conjunction with the Authority's current policies and initiatives regarding separation of existing combined sewers. Worked with the PWSA water operations department to develop plans for the relocation of 12" through 60" water transmission and distribution mains. Final project deliverables will consist of plans, details, and specifications for all utility related construction.

MALLORY GRIFFIN, PE

QA/QC LEAD

Mallory will serve as the water main QA/QC lead for this project, working directly with the utility coordination engineers and hydraulic model engineers to complete the project. Mallory has more than 11 years of experience in planning, design, and implementation of water distribution systems for major utility owners including: Pittsburgh Water and Sewer Authority (PA) as well as the City of Baltimore (MD) and Washington Suburban Sanitary Commission (WSSC) to name a few. Her water design experience includes new design, replacement, and relocation of water transmission and distribution systems, water towers, pumping stations, meter vaults, pressure reducing vaults, and trenchless rehabilitation of water systems.

YEARS OF EXPERIENCE: 11
YEARS WITH JMT: 3

TIME ALLOCATED: 10%
OFFICE LOCATION: Pittsburgh

DEGREES

- BS, 2007 Civil Engineering, Lehigh University
- BArch, 2007, Architecture, Lehigh University

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania
- NASSCO PACP/MACP

2018 Small Diameter Water Main Replacement, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. Project Manager of four (4) water mains throughout Pittsburgh ranging from 6" to 16" to replace aging infrastructure and improve reliability, hydraulic conditions, and water quality. Ms. Griffin led the team to complete utility coordination with multiple utilities and agencies including PennDOT, Hampton Shaler Water Authority, Borough of Millvale, Allegheny Valley Railroad (AVRR), Peoples Natural Gas, West Penn Hospital, PaDEP, PUC, and Pittsburgh DOMI. Preliminary and final design services were completed including full SUE, topographic survey, soil borings and geotechnical testing, test pits, corrosion and cathodic protection design, hydraulic model review, restraint and thrust design, **preliminary design of new meter vault connection to the 60-inch Lanpher main,** permitting and public outreach. Alignments include the trenchless design of seven (7) jack and bore installations with steel casing pipes underneath the AVRR.

Water Main Technical Reviews, Montgomery County and Prince George's County, Maryland. WSSC. Lead Technical Reviewer, responsible for managing the WSSC water replacement / relocation program quality control and leads a team of JMT engineers to review designs of all on-all consultants. Constructability reviews include limiting depth of excavation; coordination of air release valve locations; review of utility locations, as-built water main locations, sequence of construction; traffic control; access vaults; and elimination of unnecessary fittings and valves that do not add resiliency or redundancy. Design review includes plan and profile synchronization, thrust restraint design calculations, review of all bid documents and cost estimates. **Under this contract she has successfully completed more than 180 reviews consisting of more than 300 miles 6" – 84" pipe, over the past three years.**

Hillmeade Road Water Transmission Main, Prince Georges County, Maryland. WSSC. Project Engineer, involved in the design of 7,500 feet of new 24-inch ductile iron water transmission main. Mallory coordinated existing utilities with the new water main alignment and coordination with MDE/USACE for wetland crossings and CSX for a new jack and bore crossing beneath a major high-speed, north-south rail corridor between Washington and Baltimore. She assisted with property owner and stakeholder correspondence and development of bid documents.

Force Main Business Case, Prince Georges County, Maryland. WSSC. Deputy Project Manager, responsible for developing a business case for WSSC on the proper design, inspection methodology, rehabilitation, repair, operation, maintenance, and inspection of 47 force mains within the WSSC service area. The business case developed guidelines for best practices on pressure mains with the intent to provide resiliency and redundancy. Recommendations included transition manhole design, vault design and access spacing, pumping station layout design, wet well design, hydraulic transient analysis, retention time calculations, material analysis, and surge analysis.

Water Main Review Task Oriented Services, Charles County, Maryland. Charles County Department of Planning and Growth Management. Project Engineer, responsible for technical review services of water mains and water towers. Project roles included review and coordination of plan and profile drawings, erosion and sediment control plans, meter vault designs, thermostatic mixing tank configuration and design, existing utility locations, traffic control plans and review of technical specifications for the water tank.

CHARLES MAHER, PE

PRELIMINARY DESIGN | BID PHASE TASK MANAGER

Charles has extensive experience in the planning, design, and construction of water distribution systems, wastewater collection systems, and water and wastewater treatment processes. His professional experience includes water distribution and conveyance system planning and modeling, pump station design and rehabilitation, stormwater management, physical, chemical, and biological treatment processes, sanitary sewer rehabilitation, pipeline design, and infrastructure condition assessment and asset management. Charles is also experienced in wet weather planning and management, construction management, development and implementation of GIS, and project development, management, coordination, delivery, and quality assurance processes.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 19
YEARS WITH MICHAEL BAKER: 1

TIME ALLOCATED: 60%
OFFICE LOCATION: Moon Township

DEGREES

- MS, 1999, Environmental Engineering, Tufts University
- BS, 1996, Civil and Environmental Engineering, University of Pittsburgh

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania

Broad Creek Wastewater Pump Station Augmentation Project, Prince Georges County, Maryland. Washington Suburban Sanitary Commission. Responsible for the hydraulic model development, hydraulic analysis and transient flow analysis of the Washington Suburban Sanitary Commission's (WSSC) Broad Creek Wastewater Pump Station Augmentation Project. The project encompassed the design of a 15,000 LF, 48-inch diameter supplementary force main to augment the conveyance capacity of WSSC's existing 36-inch diameter force main. The design of the force main targeted and aligned with the full pumping capability of the Broad Creek Pump Station to convey wastewater from the Broad Creek Sewershed to WSSC's Piscataway WWTP. Work performed included obtaining existing and pending facility information, development of a hydraulic model to predict system conditions and validate system design. Work performed also included development of a transient flow model and using that model to analyze potential transient flow conditions and identify improvements to mitigate those transient conditions to within system design limits. Project responsibilities also included communicating model simulation results with project staff and coordinating the design of transient flow design measures with other engineers on the project team.

Becks Run Raw Water Transmission System, Pittsburgh, Pennsylvania. Pennsylvania American Water. Responsible for transient hydraulic analyses related to pump station upgrades at the Pennsylvania American Water's (PAWC) Becks Run Raw Water Pump Station. Work included development of a transient hydraulic computer model, analysis of transient conditions, and identification of transient control equipment and system operating recommendations to control potential pressure surges, including emergency shutdown of the upgraded pump station. Work was completed in conjunction with the implementation of major upgrades to PAWC's system to improve system performance and reliability. The upgraded raw water system included an 60 mgd pump station and four (4) parallel raw water transmission mains ranging in size from 20 to 48 inches that convey raw water from the Monongahela River to the Hays Mine Water Treatment Plant located 1.7 miles away.

Combined Sewer Overflow Long Term Control Plan, Scranton, Pennsylvania. Scranton Sewer Authority. Developed a Combined Sewer Overflow Long Term Control Plan for the Scranton Sewer Authority. Work included oversight of the GIS mapping efforts of the wastewater facilities within the SSA regional sewer system, development and calibration of a hydrologic model of the SSA regional sewer system, development and evaluation of control alternatives to mitigate combined sewer overflows, plan selection, cost estimating, and development of a post-construction monitoring plan to demonstrate system performance. Work also included extensive coordination and communication with the client and regulatory agencies to seek input and concurrence on critical assumptions and decisions to deliver a regulatory approved sustainable plan to the Authority within budget.

Island Heights Pump Station, Stowe Township, Pennsylvania. Township of Stowe. Completed conceptual and final design services to replace an aging and antiquated wastewater pump station that is part of the wastewater conveyance system in Stowe Township, PA. Work performed included an assessment of the existing pump station configuration and design, drainage area planning, sizing and design of the pumps, wet well, valve vault and force main, site development design, specification of all materials and controls, development of construction details, coordination of electrical design, and regulatory permitting.

JEFFERY FRYE, PE

FINAL DESIGN & PERMITTING | CONSTRUCTION PHASE SERVICE TASK MANAGER

Jeffery is a Professional Engineer experienced in the civil engineering field. His work experience includes project design, management and technical support to public and private sector clients comprised of municipalities, authorities, government agencies and developers. Jeffery has a diversified background providing engineering services on projects involving utility & infrastructure design and rehabilitation, site development, permitting, storm and sanitary sewer design, water supply, roadwork, erosion and sedimentation control plans, land surveying, construction inspection and project management.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 29
YEARS WITH MICHAEL BAKER: 1

TIME ALLOCATED: 40%
OFFICE LOCATION: Moon Township

DEGREES

- BSAS, 1989, Civil Engineering/Construction Engineering Technology, Youngstown State University

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania, Ohio, West Virginia

Water System Pipeline Design. Various Public and Private Sector Clients. Project/Client Manager. Projects include design and permitting for extensions and rehabilitation of existing systems along with new system designs varying from 4-inch to 30-inch diameter systems using HDPE and ductile iron pipe. Responsibilities include management and oversite of design engineering, permitting, construction inspection and project management.

Wilkinsburg-Penn Joint Water Authority, Pittsburgh, Pennsylvania. Various Waterline Replacement Projects. Engineer-of-Record/Construction Manager. Served as the Authority Engineer and performed design and construction management services for the replacement and upgrade of water distribution pipelines to service the Authority customers. The systems being designed were ductile iron pipes in varying sizes from 4-inch to 24-inch to replace existing cast iron, ductile iron distribution lines and riveted steel transmission lines. Construction was performed using open cut and directional drilling.

Case Street Sewer Separation Project. East Rochester Borough, Beaver County, Pennsylvania. Engineer-of-Record/Construction Manager. As part of a DEP Consent Order requiring the tributary communities to the Rochester Area Joint Sewer Authority (RAJSA) STP to eliminate the combined system and sanitary sewer overflows this project was undertaken using PENNVEST Funding. The project included construction of a new sanitary sewer system, converting the combined system into a storm sewer only system, permitting, construction management and inspection services.

Kindelberger Pump Station Emergency Generator and Pump Replacement. Bridgewater Borough, Beaver County, Pennsylvania. Project Engineer. This project involved the construction of a masonry block building, flow metering equipment, installation of an emergency generator and transfer switch. Also performed necessary design calculations and piping for upsizing the pumps to obtain 300 gpm discharge at 60 TDH and the installation of flow monitoring equipment for the existing Bridgewater Borough Municipal Authority's Kindelberger Pump Station that convey all sewage flow from Bridgewater Borough and the tributary communities to the Beaver Borough Sewage Treatment Plant.

Mountaineer Natural Gas Pipeline Construction, Newell, West Virginia. Mountaineer Racetrack, Casino & Resort. Engineer-of-Record/Construction Manager. Services for this project included the design of new natural gas distribution system to service facilities at the Mountaineer Racetrack, Casino & Resort. The system was being constructed as a cost saving measure to replace the existing propane system of the campus. Construction was performed using open cut and directional boring.

Rivers Casino, Pittsburgh, Pennsylvania. Owner Representative/Project Manager. Oversight and coordination assistance for all aspects of the civil and site development throughout the project and close-out. Duties included the oversight and coordination of the auger cast piles, pile caps and foundations, highway reconstruction, waterlines, storm sewer installation, sanitary sewer construction, electric upgrades, riverfront construction, precast concrete garage construction, overseeing consultants, change orders, budgeting, obtaining permit authorizations and compliance and served as the owner liaison with the City and State agencies along with many of private companies and organizations.

SRIDHAR ALUGUVELLI, PE, CFM

ROUTE EVALUATIONS | PRELIMINARY DESIGN REPORT | REGULATORY ENGAGEMENT/PERMITTING

Sridhar is experienced in civil and environmental engineering, municipal infrastructure, combined sewer separation and tunnel design, site civil/land development, sewer inspections, and construction management. He is highly skilled in the use of municipal and civil engineering technology tools and computer programs associated with Autodesk, Bentley, U.S. Army Corps of Engineers (USACE-HEC) hydrologic and hydraulic (H&H) applications, and Geographic Information Systems (GIS), with an emphasis on Sustainable Infrastructure /BMP design.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 14
YEARS WITH MICHAEL BAKER: 1

TIME ALLOCATED: 25%
OFFICE LOCATION: Moon Township

DEGREES

- MSCE, 2002, Computer Science and Engineering, Oakland University
- MS, 2003, Civil Engineering, Lamar University

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania, Ohio, Mississippi
- Certified Floodplain Manager
- Certified Professional in Erosion Sediment Control and Stormwater Quality

Sewer Separation on Centre Avenue, Crawford Street, Bedford Avenue, Washington Place. Pittsburgh, Pennsylvania. Pittsburgh Water and Sewer Authority. Project manager and chief design engineer. Performed the hydrologic & hydraulic analysis and design of the sewer separation (storm & sanitary), approximately 1300 LF along Centre Avenue between Crawford Street and Washington Place. This initial phase will provide separate storm sewer connection points (stub-outs) to allow easier direct connection as future phases of new infrastructure construction progresses within the former Pittsburgh Penguins Civic Arena site. The project is a new separate storm sewer system that will be ultimately constructed to extend upstream and downstream of the site to mitigate flows within existing combination sewers. The segment along Centre Avenue is designed to accommodate future planned flows as modeled in the City's balanced water model as provided by the PWSA. Prepared necessary permit application packages; developed construction plans, cost estimates and assisted with PS&E submittal package to the City. The project was completed in Dec 2014. Performed the preliminary design of sewer separation and roadway design of the perimeter roadways i.e., Crawford St, Bedford Ave, Washington Pl adjoining the Lower Hill Redevelopment Site.

Dugway Storage Tunnel, Cleveland, Ohio. Northeast Ohio Regional Sewer District (NEORSD). Prepared scope/cost proposal, performed QA/QC of construction plans for a 4-mile-long, 24-foot diameter tunnel and six drop shaft structures for the contractor (SI Healy JV) and NEORSD. Performed pre and post-construction inspection services of the property structures ((i.e., private residential and business structures, including roadway features such as assessing roadway pavement, sidewalks, curbs, inlets, sewers manholes, utility poles, signage, property fences and other surface features) which are in the zone of influence of proposed drop structures.

PWSA Stormwater Study, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. Project manager/lead engineer for the project. The primary goal of the project was to determine feasible stormwater management solutions for some of the identified neighborhood areas using both traditional solutions as well as LID/GI design methods which might effectively attenuate significant amounts of storm runoff prior to discharging to critical Combined Sewer Overflows (CSO) and main interceptor systems serving the ALCOSAN area. The report was developed through close coordination with the PWSA to incorporate several planning tools and concept-level design elements to meet the City's combined sewer separation goals as part of the current consent decree agreement between the City and the Environmental Protection Agency (EPA). Identified several opportunities using GIS gap analysis and update of compiled mapping and source data for neighborhood areas. Further analyses were performed for capturing stormwater to achieving both runoff and volume reduction in the downstream areas of these neighborhood areas. Identified preliminary solutions for numerous failed inlets within the City of Pittsburgh study area; preliminary unit costing analyses were performed for failed neighborhood area parcels for various scenarios based on historic project bid tabulations from similar projects in other cities/states. The unit costs were then developed for the critical line items along with contingency %ages to complete the construction cost estimates.

WENDY BERRILL, PE

PRELIMINARY DESIGN REPORT | REGULATORY ENGAGEMENT/PERMITTING

Ms. Berrill has worked extensively on roadway design and railroad design projects, utilizing MicroStation and InRoads. Ms. Berrill has developed roadway and railroad plans and profiles, cross sections, quantities, and many other aspects of highway and railroad design projects. She has also designed a railroad classification yard, worked on the design of many intermodal yards, and designed multiple railroad siding projects. Ms. Berrill has begun to accumulate project management experience, managing a railroad yard design job from preliminary engineering through construction.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 13

TIME ALLOCATED: 15%
OFFICE LOCATION: Moon Township

DEGREES

- M.B.A., 2011, Business Administration, Robert Morris University
- B.S.C.E., 2006, Civil Engineering, University of Pittsburgh

LICENSES/CERTIFICATIONS

- Professional Engineer – Civil: Pennsylvania, Michigan
- Norfolk Southern e-RAILSAFE Certification, Pennsylvania
- NS Roadway Worker Protection Certification
- CSX Roadway Worker Protection Certification

General Consulting Engineer Services for the Pennsylvania Turnpike, Statewide, Pennsylvania. Pennsylvania Turnpike Commission. Civil Engineer. Responsible for providing design reviews on various submissions including 30%, 60%, 90% and 100%. Michael Baker is providing engineering services for the Pennsylvania Turnpike under a five-year general consulting engineer contract. Michael Baker's services include operating and capital budget analyses, design and implementation of a quality assurance program for projects, preparation of annual system performance and process reports, and technical support on an as-needed basis.

Rehabilitation of the 6th, 7th, and 9th Street Bridges, Pittsburgh, Pennsylvania. Allegheny County Department of Public Works. Civil Engineer. Responsible for final design of the roadway portion of the job. This included vertical alignment work, curb ramp design work, grading, calculating quantities, compiling a cost estimate, and other additional final design items. Michael Baker is providing preliminary and final design and bid- and construction-phase services for the rehabilitation of the historic 6th Street (Roberto Clemente), 7th Street (Andy Warhol), and 9th Street (Rachel Carson) bridges over the Allegheny River. Michael Baker's services include a field survey and utility investigation; an in-depth inspection of the structures; structural analysis; line-and-grade, design field view, and type, size, and location submissions; maintenance and protection of traffic, pavement marking, roadway and structure design plans; permitting tasks, including coordinating with regulatory agencies; overseeing bridge lighting design development; developing the project bid packages, including the final plans, specifications, and cost estimates; and construction consultation.

Planning, Engineering, Architectural, and Project Management Services, Allegheny and Westmoreland Counties, Pennsylvania. Port Authority of Allegheny County. Civil Associate. Responsible for alternative roadway study and work. Michael Baker developed the concepts for a high-speed magnetic levitation transportation system in Pennsylvania. The undertaking involved a preliminary engineering study of four alternative alignments for a 54-mile demonstration project that was to connect the Pittsburgh International Airport, downtown Pittsburgh, and two suburban station locations east of the city. Michael Baker's role included developing the preliminary design for the guide way and stations, developing cost estimates, preparing an environmental overview, and managing the ridership estimate. The 54-mile system would have been the first link in an envisioned regional and national system connecting the Midwest to the East Coast.

Allegheny Riverfront Green Boulevard, Pittsburgh, Pennsylvania. Urban Redevelopment Authority of Pittsburgh. Civil Engineer. Looked into horizontal rail alternates in different locations. As a member of a consultant team, Michael Baker is providing multimodal planning services on a study of options to transform a 6.45-mile segment of freight rail right-of-way from Pittsburgh's Strip District to Lawrenceville into a green corridor that promotes walkability, intermodal connectivity, and sustainable development. Michael Baker's tasks include conducting a multimodal needs assessment; identifying preliminary alternatives in coordination with the client and community groups and conducting a feasibility analysis; developing a model to forecast transit ridership and vehicular, pedestrian, and bicycle trips; evaluating the costs and benefits of each alternative; and developing an implementation plan for the preferred alternatives.

JOHN LASKO, PG

PRELIMINARY DESIGN REPORT | GEOTECHNICAL ENGINEERING

John's background comprises a variety of geotechnical projects, as geotechnical lead on local large complex projects, involving existing tunnels, retaining walls, bridges, interchanges, railroads, riverfronts, and deep utilities. Specific project tasks included: development and implementation of core boring and laboratory testing programs, drilling oversight, geotechnical interpretation of subsurface conditions, landslide identification, characterization, investigation, and remediation, historical local geomorphology, geology, subsurface stratigraphic model development; data reporting, findings presentations, and construction consultation.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 31
YEARS WITH MICHAEL BAKER: 2

TIME ALLOCATED: 35%
OFFICE LOCATION: Moon Township

DEGREES

- M.S., 1989, Earth Science and Geology, California University of Pennsylvania
- B.S., 1985, Geology, Juniata College

LICENSES/CERTIFICATIONS

- Professional Geologist, Pennsylvania
- Norfolk Southern e-RAILSAFE Certification, Pennsylvania
- PennDOT Inspector, Level I, Pennsylvania
- PennDOT Inspector, Level 2, Pennsylvania
- 14.1.1 Soil Exploration, Pennsylvania
- 14.2.1 Geotechnical Testing, Pennsylvania

Combined Sewer Overflow Long-Term Control Plan Assistance, Pittsburgh, Pennsylvania. Pittsburgh Water and Sewer Authority. Senior Geologist. Responsible for preparation of geologic subsurface profiles for four proposed tunnel alignments to support tunneling alternatives in conceptual design. The Pittsburgh Water and Sewer Authority (PWSA) is concluding development of a Long Term Combined Sewer Overflow (CSO) Control Plan (LTCP) to reduce combined sewer overflows from the system. The plan was developed and supported using a calibrated, defensible hydraulic and hydrologic model of the system based on InfoNet and InfoWorks software by Wallingford. Michael Baker's $7.5 million fee included conversion of paper maps to GIS, field verification of overflow chambers, outlet pipes and manholes, CCTV of 30+ miles of sewer, directing the placement of 200+ flow monitors, in-stream water quality testing, asset entry into the software, development of a hydraulic model, analysis of model results and overflow prediction, alternatives identification and evaluation, report preparation, and public and regulatory coordination. The project was divided into two regions. Michael Baker was the prime consultant for Region 2, which was the larger area containing the majority of CSOs. The final calibrated sewer system model and LTCP are valuable tools for future projects designed to reduce combined sewer overflows to the waterways within the City of Pittsburgh. The total estimated construction cost for the planned improvements was more than $1 billion.

S.R. 28, East Ohio Street Improvement Project, Allegheny County, Pennsylvania. Pennsylvania Department of Transportation, District 11-0. Senior Geologist. Senior Geologist responsible for subsurface investigation and data management. Provided historic perspective of long duration project with multiple phases, alignments and studies. Michael Baker provided comprehensive engineering and environmental services to upgrade a 2-mile, four-lane section of S.R. 28 between the Chestnut Street Ramps and the Millvale Interchange to a limited-access expressway. The project included the addition of median barrier on S.R. 28, a grade-separated interchange at 31st Street, and new southbound on and off ramps at 40th Street to allow continuous mainline flow. Project challenges included minimizing hillside impacts, maintaining railroad capacity, constructing within a tight corridor, and accommodating historic structures, while enhancing safety, improving traffic flow, and coordinating with multiple stakeholders with diverse needs. Michael Baker's services included project management; environmental compliance services; value engineering; roadway, bridge, interchange, retaining wall, and multiuse trail design; utility coordination and relocation design; stormwater management design; aesthetic design; complex construction sequencing and traffic control plans; intelligent transportation system design; and construction consultation.

S.R. 79, Section A23, I-79 Missing Ramps, Collier and Robinson Townships, Pittsburgh, Pennsylvania. Pennsylvania Department of Transportation, District 11-0. Senior Geologist. Responsible for performing field and office coordination for preliminary and final design as geotechnical task manager. Tasks included test boring layout and laboratory testing program development, Level 2 drilling supervision, field data compilation, slope evaluation, rockfall hazard evaluation, mine treatment evaluation, water quality evaluation, and preliminary reports preparation. Michael Baker provided engineering services for the addition of two direct-connection ramps at the interchange of I-79 and S.R. 22/30 west of Pittsburgh. Michael Baker's services for the so-called "missing ramps" project included roadway and bridge design, drainage design, aerial mapping, traffic analysis, signal design, lighting design, intelligent transportation system design, complex maintenance and protection of traffic plans, Phase I and II environmental site assessments, and wetland and stream mitigation.

TENNYSON MUINDI, PE

TUNNEL DESIGN

Tennyson is a senior project manager with 30 years of experience on a wide range of geotechnical engineering projects. His primary area of expertise is in pipeline infrastructure and underground construction. His experience covers a broad range of service areas including planning, implementation, and reporting of geotechnical investigations; conceptual level planning and design studies; detailed design studies and preparation of contract documents; and construction phase services including office and resident engineering. Tennyson is currently serving as Vice Chair of the ASCE Pipelines Division Executive Committee (EXCOM) and Liaison to the ASCE Committee on Trenchless Installation of Pipelines.

McMILLEN JACOBS ASSOCIATES

YEARS OF EXPERIENCE: 30
YEARS WITH MCMILLEN JACOBS: 4

TIME ALLOCATED: 30%
OFFICE LOCATION: Burlington, MA

DEGREES

- MS, 1988, Civil Engineering, University of Massachusetts at Amherst
- BS, 1986, Civil Engineering, University of Rhode Island

LICENSES/CERTIFICATIONS

- Professional Engineer, Massachusetts

Installation of 115 kV Transmission-Line, Belmont Municipal Light Department, Belmont, Massachusetts. Project manager for detailed design of five trenchless crossings below existing utilities with proposed alignment running along active commuter railroad tracks. The 115 kV transmission-line circuit will be installed in two 22" steel casings spaced 3 ft on center, each including one high pressure, oil-filled cable bundle encased in a steel conduit, one fiber-optic cable for communication encased in 4" PVC pipe, and one temperature sensing wire encased in 2" PVC pipe. The lengths of steel casing installed using trenchless methods at the crossings range from 30 to 90 ft and will have invert depths of up to 17 ft below existing ground surface.

DC Clean Rivers Project, CSO Long-Term Control Plan, DC Water, Washington, DC. Geotechnical consultation for Anacostia River Tunnel, First Street Tunnel, and Poplar Point Pumping Station Replacement contracts. Includes review of geotechnical data and design reports, contract drawings, and specifications. Oversaw preparation of geotechnical baseline for Poplar Point Pumping Station Replacement which included two trenchless alignments to be constructed using microtunneling and open shield tunneling methods.

New 20" Sub-Aqueous Water Main Extension to Randall's Island, NYCDDC, Bronx, New York. Microtunneling expert for installation of new 20" water main and 12" gas main from South Bronx to Randall's Island. The main crosses under the Bronx Kill via a new microtunnel to be launched from and received in new shafts installed as part of the project. Four shafts with secant piles for soil support and twin bores will be constructed. Coordination was required with various utility operators, property owners, and the CSX railroad line that crosses the project alignment.

Yale Campus/Trumbull Street Area Sewer Separation, New Haven, Connecticut. Project manager for trenchless constructability evaluation of gravity RCP sanitary sewer and storm drains with diameters from 36" to 72". The sewer and drains run parallel to each other along an active roadway and are in close proximity to an existing 60" brick sewer constructed in the 1800s. The 1,600 LF trenchless build is located at invert depths of up to 10 ft below ground surface. Provided input on trenchless contract documents and consultation during construction.

New River Street Pump Station, City of Bridgeport, Connecticut. Project manager providing geotechnical and environmental design services for replacement of two existing pump stations on highly contaminated site. New pump station extends 27 ft below ground surface. New pipelines consist of 1,600 LF of gravity sewers and 550 LF of force mains. 880 LF of pipe constructed using microtunneling. Work undertaken included ground characterization, constructability and cost evaluation, design, bid document preparation, and consultation during construction.

Granby Street Sewer Separation Project No. 2 & 5, MDC Clean Water Program, Hartford, Connecticut. Project manager providing trenchless engineering support for 48" and 60" RCP combined gravity sewer construction. 2,400 LF was installed using microtunneling at invert depths of up to 28 ft. Services included engineering evaluations and contract document preparation, as well as consultation during bidding and construction.

HEATHER DODSON, PE, LEED AP

WORKSHOPS | REGULATORY ENGAGEMENT/PERMITTING

Heather has extensive experience in stormwater management. As an engineer she's designed storm sewer systems and stormwater management facilities and combined sewer abatement on a variety of site development projects. In addition to her hydraulic and hydrologic design experience, Heather has also aided municipalities in MS4 compliance with the Minimum Control Measurements, writing stormwater ordinances, stormwater pollution preventions plans, permitting, and feasibility studies.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 14
YEARS WITH MICHAEL BAKER: 12

TIME ALLOCATED: 10%
OFFICE LOCATION: Moon Township

DEGREES

- BS, 1999, Civil & Environmental Engineering, University of Pittsburgh

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania
- LEED Accredited Professional

Stormwater Rate Structure Feasibility Study, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. Civil Engineer responsible for the development of the stormwater authority feasibility study. Tasks include reviewing current stormwater management practices, assessing stormwater management infrastructure, evaluating wet weather needs, developing stormwater policy, aided in the creation of the user fee methodology, allocation factors and performing a GIS evaluation of infrastructure and impervious areas to establish the recommended rate structure. Conducted an operational assessment of current staff and operations to establish operational additions to accommodate the increase in roles and responsibilities. Michael Baker assisted in the evaluation of a stormwater rate structure to more equitably recover the costs of stormwater-related activities. Michael Baker's services included reviewing current stormwater management practices, assessing stormwater management infrastructure, developing stormwater policy, and performing a geographic information system evaluation of infrastructure and impervious areas.

Sheraden Park Sewer Remediation, Pittsburgh, Pennsylvania. ALCOSAN. Civil Associate responsible for civil specifications and review of cost analysis. Michael Baker provided engineering services to remove 12 streams from flowing into combined sewers in Sheraden Park and Chartiers Creek, and to restore streams that flowed through underground pipes to the surface, creating new wetlands. Michael Baker's services included mapping, data collection and system research, hydraulic modeling, preliminary and final design, preparation of final construction plans, and preparation of construction cost estimates.

Addison Terrace Redevelopment Phase I - Public Improvement Plans. Civil Engineer responsible for design and layout of public water and storm and sanitary sewer layout, calculation of cost estimates and quantity takeoffs, creation of profiles of the utilities and details for submission to the PWSA and the City of Pittsburgh.

Lower Ohio and Girty's Run Basin Planning, Pittsburgh, Pennsylvania. ALCOSAN. Civil Engineer/Basin Planner responsible for the ALCOSAN Basin wide alternatives for the Lower Ohio Basin. Tasks for this project included site analysis, site screening, and sizing and costing of a variety of SSO storage and conveyance technologies over a variety of design years (1-year through 10-year storm events) that would best fit the Lower Ohio Basin as well as finalizing the most preferred site and then basin alternatives. The analysis was then discussed in the Feasibility Report and Basin Facilities Plan for this Basin. Numerous alternatives analysis was reviewed utilizing the knee of curve graphs, ALCOSAN's Basin Alternative Ranking Tool, the ALCOSAN Alternative Costing Tool, the Tunnel Spreadsheet Tool, and alternative sizing spreadsheets. The basin planner produced a variety of sizing spreadsheets, process diagrams, alternative ranking databases, and facility checklists The Basin Facilities Plan included investigating the Environmental Assessments, possible easement requirements, the beginnings of a construction schedule, and analysis of the BP's model (including HGL and overflow concerns). Tasks also included site investigations and completion of a geotechnical review of the most preferred technology. Additionally, the Basin Planner was tasked with reviewing the municipal peak flow provided by each municipality located within the basin and checking for agreement with the basin planner values. As part of a consultant team, Michael Baker performed planning studies and engineering analyses for the Lower Ohio and Girty's Run (LOGR) Basin in support of a comprehensive regional planning initiative to fulfill consent decree requirements for the mitigation of sanitary sewer and combined sewer overflows.

DOUGLAS BOCK

SUBSURFACE UTILITY ENGINEERING MANAGER

Doug has 29 years of experience as a Subsurface Utility Engineering (SUE) Manager. Daily, he oversees field verification / designation and surveys locations of utilities. He is familiar with, and has supervised crew, on the vacuum excavations on water mains, gas, telephone, force main sewers, and fiber optic cables.

YEARS OF EXPERIENCE: 29
YEARS WITH JMT: >1

TIME ALLOCATED: 40%
OFFICE LOCATION: Pittsburgh

DEGREES

- MBA, 2001, Engineering Management, Regis University
- BS, 1999, General Engineering, Regis University
- AAS, 1995, Mechanical Design, Triangle Tech

LICENSES/CERTIFICATIONS

- ATSSA Intermediate Work Zone Traffic Control
- OSHA 10-Hour Construction Safety and Health
- On Track Safety for Contractors
- Safety Training Course in Maintenance of Traffic

2018 Small Diameter Water Main Replacement, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. SUE Manager, responsible for leading the SUE services in support of the design of four (4) water mains, approximately 10,000 LF total, throughout the city of Pittsburgh ranging from 6" to 16" to replace aging infrastructure and improve hydraulic conditions. SUE services included conducting PA OneCall, utility coordination, and 60,000 linear feet of utility designation utilizing ground penetrating radar equipment for location of existing water, gas, sewer, electric, and fiber optic lines. Pot holing was conducted at all critical pipeline crossings and tie-in connections to the existing water mains. Test hole results were utilized not only for depth and material verification, but pavement restoration and groundwater table determination. Design phase permits were acquired from Pittsburgh DOMI for street opening and traffic obstruction, Borough of Millvale, Shaler Township, PennDOT, and Allegheny Valley Railroad. Mr. Bock also coordinated with the following utilities: PWSA, Peoples Natural Gas, Verizon, Duquesne Light, and ALCOSAN.

Lanpher Reservoir, Pittsburgh, Pennsylvania. Pittsburgh Water & Sewer Authority. SUE Manager, responsible for leading the SUE services in support of the design at Lanpher Reservoir. SUE services included conducting PA OneCall, utility coordination, and 10,500 LF of utility designation utilizing Radio Frequency Electromagnetic Cable and Pipe Locators and Ground Penetrating Radar equipment for location of two existing 60" water mains. JMT provided a utility investigation for all other public and private utilities within the limits. The investigation included water vault locations and investigation of the vaults. Utility test holes were provided by vacuum excavation and was conducted at all critical pipeline crossings and proposed tie-in connections. Test hole results were utilized for depth and material verification and groundwater table determination. Design phase permits were acquired from Pittsburgh for street opening and traffic obstruction. Mr. Bock also coordinated with the following utilities: PWSA, Peoples Natural Gas, Verizon, Duquesne Light, and ALCOSAN.

Regional SUE Utility Agreement, Pennsylvania. PennDOT District 11-0. SUE Manager. As part of a regional SUE Agreement with multiple Districts, Mr. Bock is providing SUE services to include test holes and designation of 2,600 LF of water lines and gas line for the Keystone Avenue Bridge Replacement project. Mr. Bock has coordinated with the following utilities: Peoples Natural Gas, Westmoreland County Water Authority, Verizon, and West Penn Power.

SR 268 Southeast of Emlenton over Lowrey Run, Pennsylvania. PennDOT District 10-0. SUE Manager. Mr. Bock is providing SUE services to include test holes and designation of 800 LF of gas line for this bridge replacement project. JMT is responsible for the preliminary engineering, final design and construction consultation for the full replacement of the Southeast of Emlenton over Lowrey Run Bridge. Mr. Bock coordinated with the following utilities: PWSA, Peoples Natural Gas, and Verizon.

Rail Utility Investigation, Baltimore, Maryland. Amtrak. Project Manager. Investigated right-of-way along Amtrak rail line to determine unknown utility encroachments. Provided passive and inductive utility sweeps utilizing RFEMI utility locators. Coordinated with Amtrak safety officials and utility designators. Correlated known utilities with information and determined encroachment violations. Contacted known utility owners in the area and verified ownership of unknown utilities.

DON GREGOR, PE

PLANS & DETAILS

Don is a licensed engineer with experience in Hydrology & Hydraulics and GIS mapping. As a Water resource engineer, he has used HEC models extensively (both steady and unsteady modes) and routinely utilizes the interface between HEC-RAS and GIS (ARCMap) for floodplain/inundation mapping. His knowledge base includes the use of PCSWMM, HEC-RAS, HMS, GeoRAS, GeoHMS & DSSVue. He is also well-versed in the use of GIS tools for wide scale data analysis and processing specifically as it pertains to watershed and sewershed analysis He has performed these services for PWSA, 3 River Wet Weather Program, and local municipalities.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 11

TIME ALLOCATED: 50%
OFFICE LOCATION: Moon Township

DEGREES

- BS, 2007, Civil Engineering, University of Pittsburgh

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania

Program Management for Municipal Activities, ALCOSAN Service Area, Pittsburgh, Pennsylvania. 3 Rivers Wet Weather Inc. Civil Associate. Performed GIS mapping. Michael Baker is 3 Rivers Wet Weather's (3RWW) program manager, engineering consultant, and extension of staff for all 3RWW's municipal activities in response to administrative consent orders involving combined sewage overflow and separate sanitary overflow abatement in the Allegheny County Sanitary Authority (ALCOSAN) service area.

Stormwater Rate Structure Feasibility Study, Pittsburgh, Pennsylvania. Pittsburgh Water and Sewer Authority. Civil Engineer. GIS mapping and support related to the hydrologic and hydraulic analysis. Michael Baker assisted in the evaluation of a stormwater rate structure to more equitably recover the costs of stormwater-related activities. Michael Baker's services included reviewing current stormwater management practices, assessing stormwater management infrastructure, developing stormwater policy, and performing a geographic information system evaluation of infrastructure and impervious areas.

Long-Term Control Plan for Combined Sewer Overflow Control, Rochester, Pennsylvania. Rochester Area Joint Sewer Authority. Civil Associate responsible for development of hydrologic and hydraulic analysis for the Rochester Area Joint Sewer Authority (RAJSA) combined sewer system using GIS linked PCSWMM. Model calibration was preformed using flow data collected as part of this project. This model was then used for planning proposes throughout the RAJSA sewershed. Michael Baker developed a coordinated long-term control plan for the five municipalities in the client's service area in accordance with the requirements of a consent order and agreement and national combined sewer overflow policy. Michael Baker's services included developing a hydraulic and hydrologic model of the service area, creating a project GIS database, identifying and analyzing alternatives, and developing and implementing a post-construction compliance monitoring plan.

Brady's Run Sanitary Authority (Formerly Chippewa Township Sanitary Authority) Engineering Services, Beaver Falls, Pennsylvania. Beaver County Commissioners. Civil Engineer responsible for development of hydrologic and hydraulic analysis to remove and replace the undermined gabion stream bank protection along Brady Run adjacent to the Route 51 Sewer Treatment Plant. Since 2007, Michael Baker has provided retainer-type consulting engineering services to support the on-going operations of the sanitary sewerage system, including collection, conveyance, pumping, and treatment components.

Stormwater Management Plan, Allegheny County, Pennsylvania. Allegheny County Department of Economic Development. As Civil Engineer, responsible for the development of the hydrologic analysis for three major watersheds within Allegheny County. GIS mapping using shapefiles available from the City of Pittsburgh and Allegheny County was produced to support the hydrologic analysis as well as the stormwater management plan. Michael Baker is developing this stormwater management plan for the county in compliance with Pennsylvania Act 167. Michael Baker's services include data collection and analysis, field investigations, detailed hydrologic modeling, development of a project website, and public and stakeholder involvement.

BRIAN BAKER, PE

PLANS & DETAILS

Brian is a civil engineer with experience in site grading, drainage, erosion and sedimentation control, and stormwater management. He has experience in designing Erosion and Sedimentation Control Plans, Post-Construction Stormwater Management Plans, and Stormwater Pollution Prevention Plans for various ARCs. He has also helped obtain various permits from the EPA and several different State Departments of Environmental Protection.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 12
YEARS WITH MICHAEL BAKER: 10

TIME ALLOCATED: 50%
OFFICE LOCATION: Moon Township

DEGREES

- BCE, 2009, Civil & Environmental Engineering, University of Dayton

LICENSES/CERTIFICATIONS

- Professional Engineer, Pennsylvania

Master Services Agreement - Surveying Services for Gathering Lines, Northern, Western, and Central Pennsylvania; and, Ohio. Confidential Client. Civil Engineer. Responsibilities included developing a watershed model to determine the effects of gas industry developments within a watershed. This included using the ArcGIS, HECRAS, and HECHMS programs to assist in making maps and performing calculations; and dividing the watershed into smaller watersheds and finding a land use and soil condition for the entire area. Michael Baker performed preconstruction surveys, alignment sheets, construction staking, and as-built surveys of over 100 miles of midstream pipelines. Michael Baker initially performed route staking and concentrates on property evidence, environmentally sensitive areas, tree clearing, stream crossings, and other design impacts to support permitting and constructability issues. Michael Baker provided staking of proposed pipeline, limits of disturbance (LOD), and additional temporary work spaces (ATWS) prior to construction and performs in-ditch as-built surveys during construction. Final as-built alignment sheets were prepared and delivered based upon in-ditch as-builts, post-construction survey, inspector weld maps and pipe tallies, and other information.

Program Management for Municipal Activities, Pittsburgh, Pennsylvania. ALCOSAN. As Civil Associate, responsibilities included delineating storms using the Shape program and analyzing those storms with the RTK Calculator developed by LSSE. Michael Baker is 3 Rivers Wet Weather's (3RWW) program manager, engineering consultant, and extension of staff for all 3RWW's municipal activities in response to administrative consent orders involving combined sewage overflow and separate sanitary overflow abatement in the Allegheny County Sanitary Authority (ALCOSAN) service area.

FLETC-OCH Stormwater Management, Cheltenham, Maryland. As Civil Engineer, responsibilities included going on a site visit to the Maryland FLETC campus to take pictures and inventory of existing stormwater facilities. The visit included two days on site and required GPS marking of inlets, culverts, and other structures to determine if they were included on existing site information or if they needed to be added to new maps. Tasks included developing a photo log and writing a comprehensive report describing the existing stormwater facilities and any issues and solutions that may be needed on site. Also responsible for developing CAD plans to reflect updated stormwater information onsite and showing where all the stormwater onsite would eventually drain.

Design and Construction Management Master Services Contract, Southwestern, Pennsylvania. Duquesne Light Company. As Civil Engineer, responsibilities included going on site because of Stormwater Drainage and Erosion Control Issues. Developed a plan to prevent further erosion from occurring by directing water around the site to an existing drainage ditch. Tasks included mapping of drainage area, calculating stormwater draining towards site, and developing a grading and stormwater management plan to better control stormwater on site. Michael Baker is providing architectural and engineering services under a three-year master services agreement for design, preconstruction, bid phase, construction management, and other services for the renovation or improvements to the company's facilities and for major capital projects and programs.

KIM BARTOS, PWS, CE

PHASE I ENVIRONMENTAL ASSESSMENTS

The majority of Kim's career was based on conducting comprehensive field investigations of the environmental conditions of aquatic habitats and providing expertise in the assessment of ecological impacts. She has worked in the regulatory community and in the private sector, and her work experience has allowed her to offer innovative and creative design options of wetland and stream impacts and mitigation based on her knowledge as both a regulator and consultant. She can offer both perspectives concerning the identification of the resources along with permitting recommendations.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 18
YEARS WITH MICHAEL BAKER: 6

TIME ALLOCATED: 10%
OFFICE LOCATION: Moon Township

DEGREES

- B.S., 1999, Biology/Applied Ecology, University of Memphis

LICENSES/CERTIFICATIONS

- Professional Wetland Scientist
- Certified Ecologist
- USACE Wetland Delineator Certification
- Wetland Certification Training
- Certified PADI Scuba Diver
- Rosgen I, Applied Fluvial Geomorphology
- Mine Safety & Health Administration Certification
- PA DCNR Wild Plant Management Permit, Pennsylvania
- FEMA Basic Professional Development Series

Master Services Agreement - Surveying Services for Gathering Lines, Northern, Western, and Central Pennsylvania; and, Ohio. Confidential Client. Environmental Permit Coordinator. Responsible for permit guidance provided for a proposed pipeline. Submitted a wetland delineation report for a forensic aquatic survey. Michael Baker has been performing preconstruction surveys, preparing alignment sheets, performing construction staking, and conducting as-built surveys of over 100 miles of midstream pipelines. Michael Baker initially performs route staking and concentrates on property evidence, environmentally sensitive areas, tree clearing, stream crossings, and other design impacts to support permitting and constructability issues. Upon routing stakeout and constructability walk, final preconstruction surveys are performed and alignment sheets displaying a plan and profile of the pipeline are prepared. Michael Baker provides staking of proposed pipeline, limits of disturbance (LOD), and additional temporary work spaces (ATWS) prior to construction and performs in-ditch as-built surveys during construction. Final as-built alignment sheets are prepared and delivered base upon in-ditch as-builts, post-construction survey, inspector weld maps and pipe tallies, and other information.

Natural Gas Pipeline Design, Cambria County, Pennsylvania. Peoples Natural Gas Company. Environmental Permit Coordinator. Responsible for wetland delineation, T& E clearance and permit submittal for gas line replacement project. Michael Baker served as the designer of record for the design-build construction of a 6.5-mile 20-inch steel natural gas transmission pipeline. Michael Baker's services included alignment surveys, base mapping, alignment design, geotechnical investigations, environmental permitting services, railroad and highway crossing permitting services, pipeline mechanical design, construction support services, and preparation of as-built drawings.

Design and Permitting of a Gas Pipeline. Confidential Client. Assistant Project Manager. Responsible for assisting with the permitting and design of the proposed pipeline, including avoidance/minimization of aquatic resources.

Gasline Rights-of-Ways Pennsylvania. Confidential Client. Conducted the baseline wetland delineation and water assessment investigations and reports prior to pipeline layout to avoid and/or minimize aquatic resources impacts in Cambria County, PA. Submitted both state and federal permits when required. Responsible for the environmental portions of the permit applications including the Environmental Assessment and stream mitigation plan.

Retainer and Miscellaneous Services, 1999-2013, North Sewickley Township, Pennsylvania. North Sewickley Township. Technical Specialist. Responsible for permit guidance concerning maintenance of dam and impacts to aquatic resources. Michael Baker has been retained as the North Sewickley Township Municipal Authority's engineer since the Authority's inception in 1952. As Consulting Engineer, Michael Baker attends public meetings; provides engineering design and permitting for waterline extensions, water storage tank painting, and other capital system improvements; develops construction standards for the system; reviews developers' plans; prepares the Consulting Engineer's Annual Report to comply with Trust Indenture requirements; provides Authority engineering representation in support of legal negotiations; and provides budgeting, rate setting, and system connection fee guidance.

STEVE STUART, PE, PTOE
TRAFFIC DESIGN

Steve has performed and managed transportation planning studies and traffic engineering design services for numerous projects in Pennsylvania. His planning experience includes traffic impact studies, multimodal mobility studies, highway and intersection capacity analyses, deficiency analyses, accident analyses, as well as pedestrian and bikeway safety improvement studies. His technical design expertise includes traffic signals, signal systems, signing/pavement markings, traffic control during construction, and ITS plan development.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 19
YEARS WITH MICHAEL BAKER: 12

TIME ALLOCATED: 15%
OFFICE LOCATION: Moon Township

DEGREES
- B.S.C.E., 1999, Civil Engineering, University of Dayton

LICENSES/CERTIFICATIONS
- Professional Traffic Operations Engineer
- Professional Engineer: Ohio, Pennsylvania, Illinois, Wisconsin, Indiana, Texas, Michigan, West Virginia, Kentucky, Florida

E02894 S.R. 4084 – A04 East Ohio Street Improvement Project, Pittsburgh, Pennsylvania. Pennsylvania Department of Transportation, Central Office. Senior Engineer. Provided technical guidance on the accommodation of bikes and pedestrians through the project. Also provided QA/QC reviews on the traffic engineering components of the job. Michael Baker is providing engineering design services for S.R. 4084, Section A04 East Ohio Street from Nash Street to Chestnut Street and for East Street and Madison Avenue from East Ohio Street to the East Street overpass spanning S.R. 0279. Michael Baker will oversee preliminary engineering, final design, and construction phase services for roadway reconstruction and preservation of four existing bridges. The work includes bridge inspection, roadway design, structural design, geotechnical investigation, utility coordination, maintenance and protection of traffic, signing and pavement marking plan, drainage design, pavement design, paint evaluation, asbestos investigation, field surveys, environmental documentation, and public involvement services.

Lower Hill Redevelopment Infrastructure Project, City of Pittsburgh, Allegheny County, Pittsburgh, Pennsylvania. Sports and Exhibition Authority of Pittsburgh and Allegheny County. Task Manager. Responsible for the development of traffic signal, signing, and pavement marking plans for the internal and perimeter streets. Michael Baker is performing preliminary engineering and final design services for the infrastructure associated with recreation of the street grid system for the Lower Hill Redevelopment Infrastructure Project (former Civic Arena site). The project includes the infrastructure (streets, sidewalks, utilities, and landscaping) necessary to support proposed development of the site to attain LEED® certification. Michael Baker will provide design services, including preliminary engineering, final design, and construction phase services. In addition, Michael Baker will prepare the environmental document and obtain the environmental clearance required to advance the project, including an environmental site assessment, Phase I and II archaeological investigations, and a pre-final geotechnical engineering report.

S.R. 28, Highland Park Bridge Interchange, Allegheny County, Pennsylvania. Pennsylvania Department of Transportation, District 11-0. Senior Engineer. Responsible for providing technical guidance on the development of improvement alternatives and the traffic engineering analysis. Michael Baker's services include project management; alternatives development and analysis; environmental compliance services; value engineering; roadway, bridge, interchange, and retaining wall final design; utility coordination and relocation design; stormwater management design; aesthetic design; complex construction sequencing and traffic control plans; intelligent transportation system design; and construction consultation.

S.R. 28, East Ohio Street Improvement Project, Allegheny County, Pennsylvania. Pennsylvania Department of Transportation, District 11-0. Traffic Engineer. Responsible for providing technical expertise in the design and operation of traffic signals, and coordination with changeable lane control. Michael Baker provided comprehensive engineering and environmental services to upgrade a two-mile, four-lane section of S.R. 28 between the Chestnut Street Ramps and the Millvale Interchange to a limited-access expressway. Michael Baker's services included project management; environmental compliance services; value engineering; roadway, bridge, interchange, retaining wall, and multiuse trail design; utility coordination and relocation design; stormwater management design; aesthetic design; complex construction sequencing and traffic control plans; intelligent transportation system design; and construction consultation.

PETER QUINTANILLA

MUNICIPAL/COMMUNITY ENGAGEMENT

Peter is the Urban Design Studio Lead for the Pittsburgh office of Michael Baker, and has an extensive experience working with communities and cities around the world. For the past four years, Peter has focused on urban design of master plans, code writing, community participation workshops, and illustrations. He worked in several design projects for cities like Anaheim and Tustin California, along with regeneration strategies including the pattern book for community-based regeneration in Clovis.

Michael Baker
INTERNATIONAL

YEARS OF EXPERIENCE: 20
YEARS WITH MICHAEL BAKER: 1

TIME ALLOCATED: 5%
OFFICE LOCATION: Moon Township

DEGREES

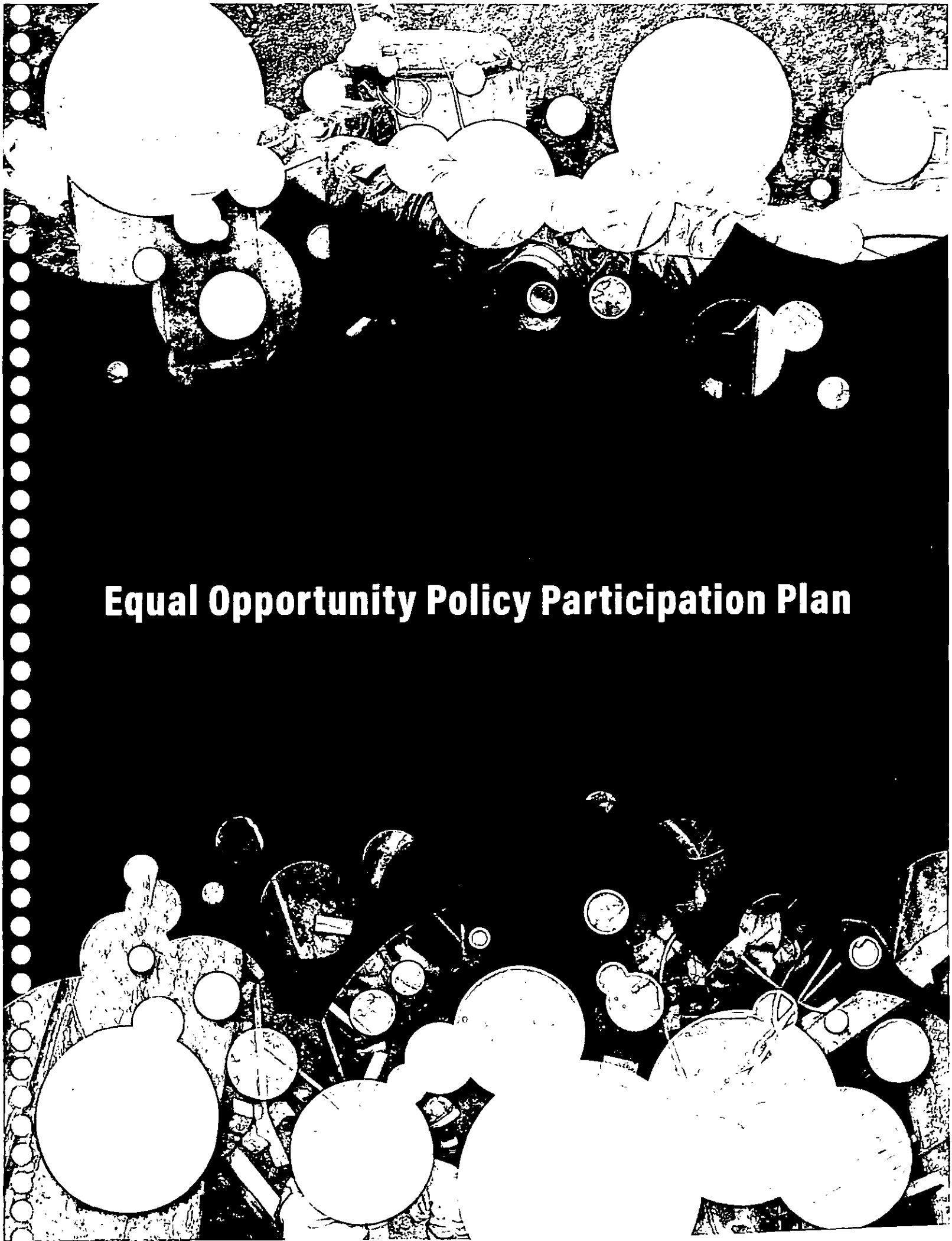
- M.Arch., 2003, Architecture/Urban Design, University of Miami
- B.A., 1999, Chemistry, University of Miami

Mon-Oakland Mobility Plan, Pittsburgh, Pennsylvania. City of Pittsburgh, Pennsylvania. Project Manager. Responsible for project management and leading public engagement events. Also responsible for directing the production of all materials for the public engagements and final project report. Michael Baker developed an alternative mobility concept that would provide new transit connections for the residents of Hazelwood, Greenfield, and Four Mile Run. Seeking to build community consensus, Michael Baker created a methodology of extensive public consultation with over eight community and stakeholder meetings and evaluated five possible alternatives. Additionally, Michael Baker conducted several site visits to help create the best route for this system. The Mon-Oakland Mobility Plan quantified demand and connectivity access between neighborhoods and Oakland; explored routes and technologies to meet demand; recommended mobility facilities for design that can coincide with the Four Mile Run Green Infrastructure Project; and identified the associated provisions and policies to make a new connection work. The Mon-Oakland Mobility Plan is expected to be implemented by 2021.

Festival Mall Regeneration Design and Strategy, City of Woodland, California. Congress for the New Urbanism California Chapter. Lead Designer. Working with city planning department, local stakeholders and representatives from the Festival Mall in Woodland, Peter created a phased approach redevelopment masterplan for the dying mall. Creating a four-phase approach to redevelopment allowed the current struggling business in the mall to remain while new facilities were built. During the initial phased, most of the businesses would be relocated to a new neighborhood center green space. This newly designed space, and the integration of new four stories residential building, would form the new heart of the community. The existing large big box retailers would remain and integrated in the overall masterplan to become "terminating views" to the new road network that would cut through the existing dying structure. The final design was heavily influenced by the community input for public gathering space, and the use of alternative architecture around the green space.

Commercial Corridor Pattern Book. City of Clovis, California. Lead Designer. Working together with the planning department for the City of Clovis and business owners, Peter developed a kit of part – book approach to redevelopment of strip mall. This innovative approach allowed the shop owners participate with building owners in the conversation with the city to redevelop Shaw Avenue Corridor. The pattern book focused on three different players in the redevelopment of the corridor, the existing shop owners, building owners, and the city. By creating a kit of part that showed each of these players how they can contribute "10%" of the redevelopment, meant that overall the final product was a greater than the individual contribution.

Downtown Regeneration and Urban Design. City of Oxnard, California. Congress for the New Urbanism California Chapter. Lead Designer. Responsible for leading the Urban Design component of the charrette, and retail regeneration for the city of Oxnard Downtown District. This five-day charrette was open to local stakeholders, business owners, local grassroot organizations and residents at large. Peter worked with residents and city planning officials and business owners to craft a new vision for how Oxnard can regenerate. During the workshop, it was determined that most of the downtown business dealt with the music industry. This finding ultimately helped to guide the final vision. Other elements focused on included street redesign, public open space rededication, and building façade improvement.



Equal Opportunity Policy Participation Plan

SECTION 6: EQUAL OPPORTUNITY POLICY PARTICIPATION PLAN

Part of our commitment to the Pittsburgh region is our commitment to small, minority-owned, women-owned, and veteran-owned businesses. Michael Baker is committed to meeting the minority, women, veteran, and service disabled veteran owned business (MBE/WBE/SDVOBE/VOBE) goals established by the PWSA for this contract.

The subconsultants that have been identified and are ready to add value to this project are:

FIRM	AREAS OF EXPERIENCE/EXPERTISE	ANTICIPATED RESPONSIBILITIES	PAST EXPERIENCE WORKING TOGETHER
Ackenheil Engineers, Inc. (MBE)	◊ PWSA, PennDOT, PAAC and PTC projects ◊ Geotechnical Engineering ◊ Material Testing ◊ Landslide Remediation	◊ Task 1 & 2 – Soil and Rock Testing	◊ PWSA Open End ◊ East Ohio Street Improvements ◊ Raccoon Creek State ◊ Martindale Park Sewer Line Relocation
Brean Associates (WBE)	◊ Community Engagement/Public Outreach	◊ Task 2: Municipal and Public Outreach	◊ ALCOSAN Preliminary Plans
Cosmos Technologies (MBE)	◊ ALCOSAN, PWSA and 3RWW Experience ◊ CCTV Experience ◊ NAASCO-Certified Inspectors	◊ Task 2: CCTV Review ◊ Task 4: Field Investigation/Site Meetings	◊ 3RWW Program Management ◊ ALCOSAN Regional Collection Flow Monitoring Plan ◊ ALCOSAN Flap Gates Improvements ◊ Lower Hill Redevelopment ◊ ALCOSAN Lower Ohio/Girty's Planning Basin
Executive Solutions Associates (SDVOSB)	◊ Cost Estimating ◊ Scheduling	◊ Task 2 - Project Schedule ◊ Task 2 – Opinion of Probable Construction Costs ◊ Task 2 – Value Engineering Services	◊ ALCOSAN Plant Expansion
Monaloh Basin Engineers, Inc. (WBE)	◊ Surveying	◊ Task 1 & 2: Topographic Survey	◊ Various PennDOT projects
Sci-Tek Consultants, Inc. (MBE)	◊ Environmental Assessments ◊ Geotechnical Expertise	◊ Task 2: Phase 1 Environmental Assessment	◊ PWSA Stormwater Utility Feasibility Study
AWK Consulting Engineers, Inc. (MBE)	◊ Geotechnical Testing and Engineering ◊ Topographic Survey	◊ Task 1 & 2: Geotechnical Borings	◊ PennDOT (various projects) ◊ PAT – Wabash Tunnel & West End Circle Improvements ◊ Allegheny Co. DPW (various projects) ◊ PaDEP (various projects)
Robinson Pipe Cleaning (WBE)	◊ CCTV	◊ Task 1: CCTV	◊ Numerous CCTV and pipe cleaning contracts for PWSA, ALCOSAN and the City

Michael Baker's long-standing commitment to DBE involvement goes beyond simply assigning tasks to firms, rather there is a goal of involving firm's personnel in the day to day project workings. This enables smaller firms to further develop skillsets and become better

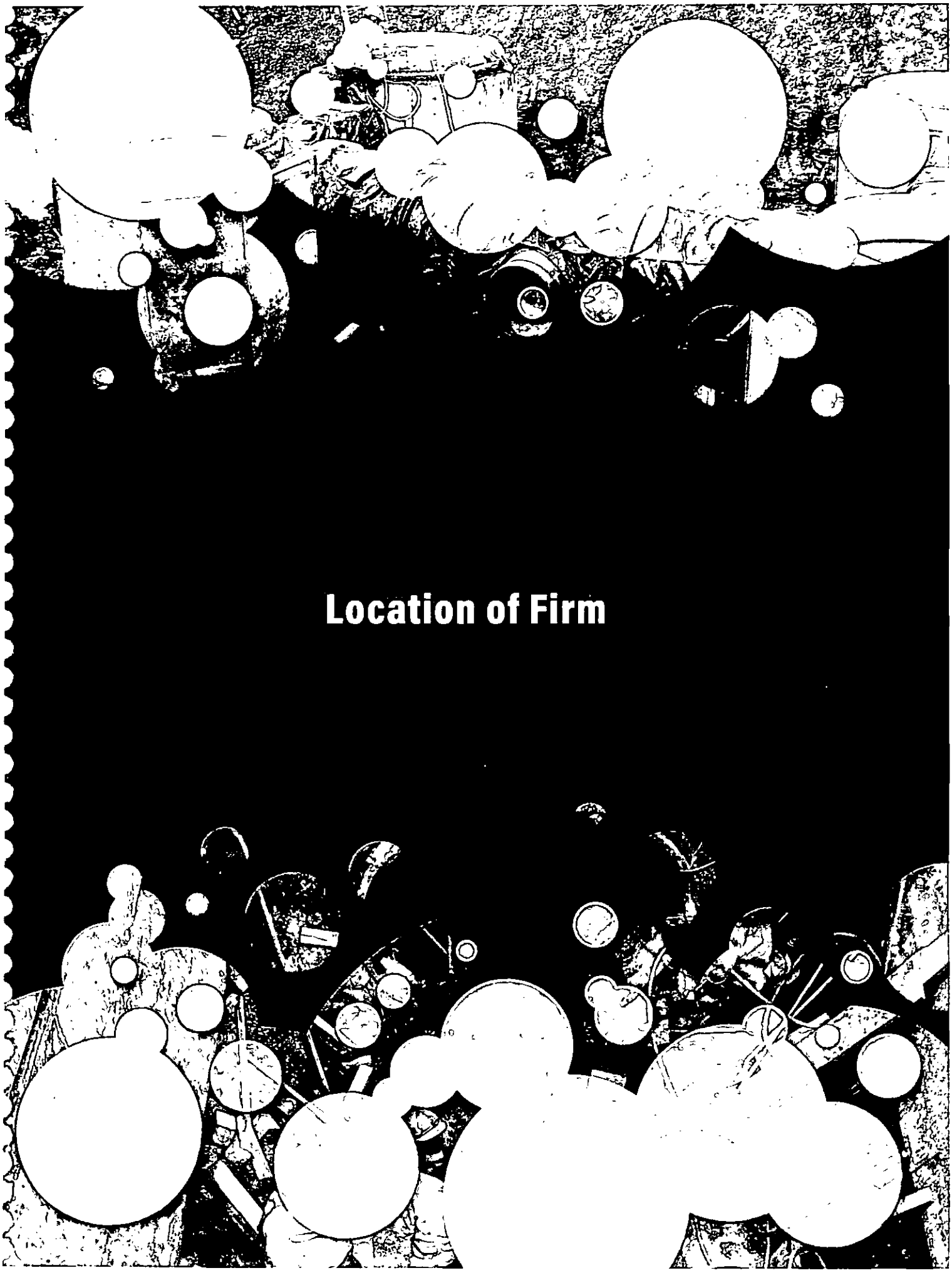
exposed to multidisciplinary projects. On large projects, Michael Baker frequently arranges to have subconsultant's staff work in the project office, which provides an efficient team atmosphere and ensures that the subconsultants participate and benefit from the day to day project functions. This also encourages small firms to take more of an ownership role in the overall project and have opportunities to interact with the client/project owner.

SOUTHWESTERN PENNSYLVANIA ENGINEERING OUTREACH SPEO

As a company, Michael Baker is an active "mentor firm" member of the Southwestern Pennsylvania Engineering Outreach (SPEO). SPEO's mission is to provide mentoring and opportunities to the protégé MBE and WBE members. This provides Michael Baker with an effective network of firms with whom we can collaborate, based on the needs of specific projects. Since its inception, Michael Baker has committed one of our staff to serve on the Board of Directors. Currently, Brad Duda serves in this capacity.

Michael Baker will be involved in every aspect of this project and will be 100% responsible and accountable for the work performed by its in-house professionals and its subconsultants. The DBE subconsultants will be an integral part of the Michael Baker team and will work together on meaningful project assignments. It is anticipated that key personnel from each DBE firm will supplement Michael Baker's staff and may be assigned management of responsibilities on specific tasks. Michael Baker will perform quality assurance checks of all services provided. Michael Baker is committed to meeting the 18% MBE, 7% WBE, 5% VBE, and 5% SDVBE goals of the PWSA.

Please refer to the Price Proposal for EOP forms and subcontractor DBE certifications.

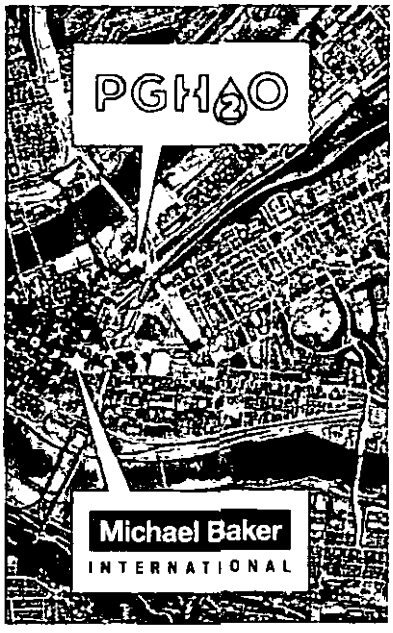


Location of Firm

SECTION 7: LOCATION OF FIRM

DIFFERENTIATOR

UNMATCHED LOCAL KNOWLEDGE & BENCH STRENGTH



LOCAL FIRM, LOCAL PROJECT MANAGER, LOCAL TEAM

Michael Baker has its roots the western Pennsylvania region, starting as a municipal engineering and survey firm. Over its 75+ years, we have grown to a global leader, delivering sustainable engineering and construction projects with nearly 3,400 employees in 82 offices. As we continue to grow, we have remained *committed to providing our local clients with excellent customer service* through technical solutions that meet project schedules and budgets.

Michael Baker has two local offices with over 600 professionals, ready to serve the PWSA. Our 500 Grant Street location is only a 10-minute walk from the PWSA office. Michael Baker's other Allegheny County location is at 100 Airside Drive in Moon Township. This office is only a short 20-minute drive to the PWSA office and anticipated project locations. This location contains Michael Baker's civil and environmental engineering groups, construction services team, and architectural, structural, electrical, mechanical engineers, and support staff. Michael Baker can draw upon these resources to respond to all PWSA requests.

PWSA can be assured that Michael Baker's 100% local team has the experience and proximity to expediently address potential challenges that might impact level of effort or schedule delays.

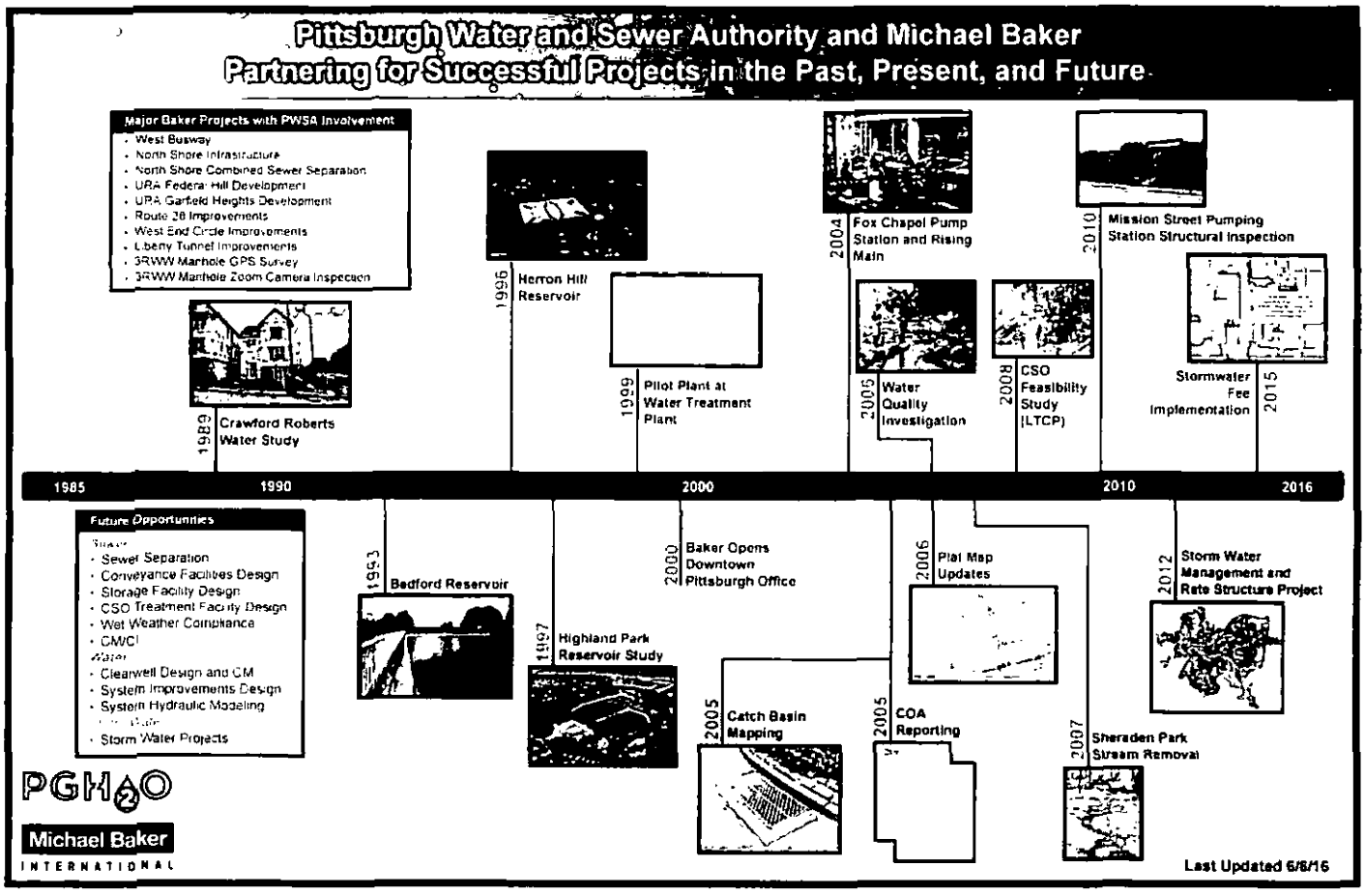
The members of the Michael Baker team are thoroughly connected in the Pittsburgh area, not only as workers but as residents. Our employees are keenly interested in the growth and improvement of our local water/wastewater systems, building, and infrastructure because this is their hometown.

Michael Baker is the largest Pittsburgh based firm with over 600 professionals living within the region ready to assist PWSA enhance our hometown infrastructure.

Brad Duda, PE, Project Manager | *No other local firm has a project manager that understands the PWSA system better than Brad.* He has worked on virtually all of projects that Michael Baker has performed for the PWSA in variously capacities since 1989. Brad has spent the majority of his nearly 30-year career with Michael Baker working on large, complex, high profile infrastructure projects in the City of Pittsburgh and Allegheny County. In addition to his experience managing projects owned by the PWSA, he also has extensive experience managing design and construction services/inspection work on City, County and State agency owned projects with incorporation of millions of dollars' worth of PWSA-owned water and sewer infrastructure.

His most relevant experience related to this project was the PennDOT State Route 28 East Ohio Street Reconstruction, which incorporated replacement of major PWSA water transmission mains of 24" and 60" diameter as required to enable roadway reconstruction and provide the PWSA with new, reliable transmission mains to provide potable water from the Lanpher Reservoir to the North Side distribution system. Work included detailing of specialized valves, vaults, fittings, transition fittings and appurtenances required to deliver documents for bidding and construction.

In the 1990's, he oversaw engineering design services for major PWSA water distribution system capital improvements, notably the Herron Hill Reservoir cover/rehabilitation project and the Fox Chapel Pump Station and Rising Main project. Both projects involved major capital construction that enhanced water system operations and regulatory compliance. They also required closely coordinated design efforts as they modified active water distribution systems. When the City of Pittsburgh and Sports and Exhibition Authority embarked on multi-million-dollar projects to construct the signature North Shore development between the two new sports facilities, Brad managed design of all new water distribution and sanitary sewer facilities built for the PWSA as incorporated work under four separate construction contracts. More recently, he managed design of the PWSA water, storm and sanitary sewer facilities for the Lower Hill Redevelopment Project and the Centre Avenue Sewer Separation Project.



A timeline of Michael Baker's project history with the PWSA

DIFFERENTIATOR

RELATIONSHIP WITH THE LOCAL MUNICIPALITIES AND STAKEHOLDERS

The proposed rising main construction will have significant impacts on the various municipalities through which it is proposed to be routed. Each municipality is unique with regards to political makeup and ability to interface with the design team for a major infrastructure project. The need for sensitivity to their concerns while keeping focused on the project goals is of the utmost importance. Construction of a waterline of this size will have drastic impacts as extensive excavation progresses along the various routes, many of which may traverse historic neighborhoods, business districts, public transportation routes, and other sensitive areas. The ability to analyze the impact on the project on the communities and develop strategies to manage the impacts is critical. The need for positive "leave behinds" will be critical to gaining the acceptance of the project. Because the project is a transmission main, rather than a distribution main, the benefit to the communities through which it will be routed may not be considered as significant, but the disruption that construction causes is very significant. Michael Baker has established relationships with all the affected municipalities and their consulting engineers because of the numerous projects that we are currently involved in. In addition, we have worked closely with the local communities as the Program Manager for the 3 Rivers Wet Weather project. Additionally, Michael Baker serves as the Project Manager for the Allegheny County Act 167 Stormwater Plan and worked closely with many local utilities during the PennDOT Route 28 Relocation Project. Through our work with 3 Rivers Wet Weather and the Allegheny County Economic Development has put Michael Baker in front of Township and Borough Managers, Engineers, and Public Works Department Employees as well as local regulators such as the PaDEP and the Allegheny County Conservation District. We have facilitated committee meetings and assisted these diverse groups in coming together for consensus on the Allegheny County Act 167 Ordinance requirements and on recommendations on wet weather solutions and regionalization with ALCOSAN and the PWSA.

SUBCONSULTANT TEAM MEMBERS

Michael Baker has assembled a Pittsburgh-centric team that has an extensive local project experience as a team and collectively understands how to deliver PWSA projects. We have carefully chosen our team members to complement Michael Baker's capabilities, offering the PWSA the resources to successfully execute this project. The subconsultants who have been identified and are ready to add value to this project are:

Johnson, Mirmiran & Thompson | Modeling and QA/QC. Johnson, Mirmiran & Thompson, Inc. (JMT) is a multi-discipline design and construction services firm with 47 years of experience in providing high-quality, timely services on a multitude of engineering projects, including water distribution and construction projects, in Pittsburgh and throughout the eastern United States. JMT is currently ranked No. 57 on the *Engineering News-Record*'s list of the Top 500 Design Firms and was *ENR*'s 2015 Mid-Atlantic Engineering Firm of the Year. Their staff of more than 1,600 professionals – engineers, architects, landscape architects, planners, environmental scientists, surveyors, construction and program managers, inspectors, designers, CADD technicians, and GIS and information technology specialists -- is dedicated to the highest-quality project performance.

Much of the work performed by JMT for this contract, including hydraulic modeling, SUE, and water main design quality control, will be administered and performed out of their Pittsburgh office (less than 11 miles from the PWSA). Locally, JMT offers a staff composed of more than 90 engineers, field technicians, and inspectors, and is fully equipped with the equipment and crew required to perform SUE services. Mallory Griffin, PE, also based in Pittsburgh, will lead JMT's team and brings an established working relationship with PWSA personnel having served as the Project Manager and Lead Engineer for the design of four water main replacement locations 6-16" across the city of Pittsburgh, including survey, subsurface utility designation, test pits and soil borings, hydraulic modeling, permitting, and public outreach. JMT has provided innovative approaches to water main replacement/rehabilitation projects for major utilities that have saved clients capital and operational costs.

McMillen Jacobs Technologies, Inc. | Trenchless Crossings. McMillen Jacobs Associates (McMillen Jacobs) provides practical, cost-effective, and innovative solutions for difficult underground projects, including wastewater conveyance facilities and CSO projects. With more than 60 years of commitment to excellence and proven expertise in the field, McMillen Jacobs continues to offer clients unique solutions to their projects. For wastewater and CSO system tunnel design and construction projects, this means that clients enjoy the benefits both of proven, efficient construction methods and state-of-the-art approaches. Since the late 1980s, McMillen Jacobs has been involved with most of the major clean water infrastructure initiatives in the United States. With more than 70% of business consisting of water-resource-related tunnel projects, they have the knowledge and experience to work on multifaceted assignments. From large-diameter interceptor sewers and combined sewer overflows to smaller diameter force mains and trunk sewers, McMillen Jacobs is the wastewater tunnel expert.

Executive Solutions Associates | Cost Estimating. Executive Solutions Associates (ESA) provides several key areas of support to its clients, with primary strengths that include project management and strategic development oversight, client/agency coordination, and engineering/surveying technical solutions. ESA provides capabilities in certain key technology strengths including survey and "ground truth" data acquisition, full–scale engineering design, infrastructure asset management, utility relocation coordination, multi–team project participation support (data transfer and interoperability), stakeholder training and education, and strategic project management and process efficiency planning. ESA's staff have worked over a number of years in support roles on large public projects for such agencies as the Allegheny County Sanitary Authority (ALCOSAN), Pittsburgh Water & Sewer Authority (PWSA), the Port Authority of Allegheny County, the US Army Corps of Engineers (USACE), and other local, state, and federal agencies. ESA is a Department of Veterans Affairs (VA) verified Service-Disabled Veteran-Owned Small Business (SDVOSB).

Ackenheil Engineers, Inc. | Geotechnical Testing. For more than 50 years, Ackenheil Engineers, Inc. (Ackenheil), has provided geotechnical engineering, construction inspection, and field and laboratory materials testing services to both public and private sector clients. Ackenheil's recent project experience includes engineering, inspection, and testing on numerous water and sewer line installation projects for ALCOSAN, Allegheny County DPW, the city of Pittsburgh, and the PWSA. Our personnel include registered professional engineers specializing in geotechnical and civil engineering, geologists, construction inspectors, field technicians, laboratory technicians, CADD specialists, and technical and administrative support personnel. Our total staff fluctuates between approximately 10 and 15 employees. Our laboratory, located at 1000 Banksville Road, is accredited by the AASHTO Materials Reference Laboratory (AMRL) for soil, concrete, and asphalt testing, as well as by CCRL for concrete testing.

AWK Consulting Engineers, Inc. | Geotechnical Investigation. AWK Consulting Engineers, Inc. (AWK) is a highly qualified DBE consulting engineering firm that was established in 1983 and is in Pittsburgh, Pennsylvania. Our capabilities encompass several engineering disciplines, including geotechnical, hazardous waste investigations, pavement evaluation and rehabilitation design, surveying, structural, and construction inspection and management. In addition, AWK possesses in-house drilling capabilities.

Karen Brean Associates | Community Outreach. Founded in 1996, Brean Associates represents an alliance of experienced professionals specializing in community planning and public participation. Karen's strong relationships throughout the region allow the firm to expand as necessary to meet specific project needs. The firm is certified as a Disadvantaged Business Enterprise by the Pennsylvania Unified Certification Program and is a PennDOT Engineering and Construction Management System Business Partner.

Monaloh Basin Engineers | Survey and Mapping Support. Monaloh Basin Engineers is a WBE/DBE practicing in the civil engineering field, providing survey, right-of-way, utility coordination, and construction inspection services. The firm was founded in 1980, has been in continuous operation since inception, and has grown in scope and experience as survey technology has evolved. Monaloh Basin Engineers is headquartered in Pittsburgh, Pennsylvania, and has branch offices in Mechanicsburg, Pennsylvania, and Morgantown, West Virginia. The firm has a staff of registered professional engineers and professional land surveyors supplemented by CADD technicians, survey crew chiefs, instrument men, and certified construction inspectors. Monaloh Basin Engineers has licensed professionals registered in Pennsylvania, Ohio, West Virginia, North Carolina, and Kentucky.

Sci-Tek Consultants, Inc. | Phase I Environmental Assessment. Sci-Tek is an engineering, surveying, and consulting firm with 22 years in business. A certified minority business enterprise, we offer expertise in land and boundary surveying, site civil design, design engineering services, water resources engineering, environmental site assessment and remediation, geotechnical engineering, and construction materials engineering and testing services. Among our 41 employees are engineers, geologists, and surveyors with professional registrations and certified environmental scientists, technicians, and specialists in various industries. Sci-Tek has completed more than 900 projects that have encompassed a broad range of challenges. Clients are served throughout the eastern United States from our Pittsburgh, Philadelphia, and Cleveland offices, and include federal, state, and local government agencies; private corporations; and engineering and architectural firms.

Cosmos Technologies, Inc. | Field Investigation. Cosmos Technologies, Inc. is a civil engineering, construction management and inspection, environmental, energy management, and surveying company. Our expertise encompasses site infrastructure design, grading design, and stormwater management, with a heavy emphasis on Low Impact Development (LID) and Green Infrastructure (GI) Design, building systems engineering, including building automation, wastewater treatment engineering, environmental and safety management, and innovative wastewater treatment research and process development.

Robinson Pipe Cleaning | CCTV. Robinson Pipe Cleaning Company (Robinson) is a privately-owned company that is part of the Carylon Corporation. Robinson's main operating facility is located in Pittsburgh. Almost 70 years ago, the company became the first to research, develop, and successfully use closed-circuit television to inspect sewers for leaks and blockages with excavation. This new method of sewer inspection literally revolutionized the industry and is the basis for the present-day maintenance of the world's sewer infrastructure. Using the latest CCTV equipment and reporting methods, Robinson can provide unmatched quality, flexibility and reliability in sewer inspection. Trouble spots, such as cracked or broken tiles, offset joints, and blockages are quickly and precisely located without excavation. Software produces the most sophisticated, yet user friendly, data collection, analysis, reporting and archiving. With extensive and usually predefined input possibilities, all data needed for pipe inspections and rehabilitation plans can be quickly and completely registered. Project information, pipe section observation and photos can be directly analyzed on screen. Data is stored on DVD, portable drive, and cloud storage for retrieval in seconds. To help make engineering decisions even easier, a huge variety of statistics, manhole and pressure test protocols, inclination profiles, and crack-width measurements are available.


Price

SECTION 8: PRICE

Please reference the sealed Price Proposal provided under separate cover.

ASSUMPTIONS AND EXCLUSIONS
It is assumed that Michael Baker will, if awarded, be operating under the conditions laid out under our existing Master Service Agreement with the PWSA.

TASK 1: PRELIMINARY DESIGN REPORT

A. REVIEW OF 2016 FEASIBILITY REPORT:

- The PWSA will provide any additional existing data including:
  - Existing and latest version of the PWSA hydraulic model,
  - Existing pump conditions/data for all pumps at the Aspinwall Pump Station,
  - Existing CCTV of sewer utilities,
  - Existing Record Drawings
- The PWSA will provide an electronic copy of the 2016 Feasibility Report at or prior to the Kickoff Meeting.

B. FIELD AND/OR DESKTOP INVESTIGATIONS

- The Michael Baker Team shall perform two (2) days of Field investigation to review the proposed alignment.
- Hydraulic Modeling review includes preliminary review of two (2) alignment alternatives with 18 model scenarios.
- The Michael Baker Team shall perform desktop survey and utility investigations is limited to what is publicly available, including:
  - National Wetland Database
  - Sanborn Maps
  - Historic Mapping/Aerials
  - PNDI
  - PWSA Water and Sewer Mapping
  - Allegheny County GIS Data
  - PASDA Data

C. PRELIMINARY DESIGN REPORT

- The Michael Baker Team shall provide a maximum of two (2) alternative alignments, with preliminary level cost and construction schedule estimates for approval by the PWSA based upon the constraints and conflicts discovered during evaluation.
- The PWSA will have 15 business days to review the Preliminary Design Report.
- The Design Report will include:
  - Narrative describing the highest ranking alternative,
  - Phase I ESA Screening information,

- Alternate alignment concept plans showing route, crossings with larger utilities, trenchless crossing locations, and road and railway impacts,
- Pressure calculations and preliminary pipe class determinations,
- Permit Matrix,
- Risk Assessment determination,
- Constructability review,
- Schedule updates,
- Easement impacts.

D. WORKSHOP

- The Michael Baker Team shall perform no more than one (1) public meeting/workshop to discuss the alternative alignment with the PWSA.
- The Michael Baker Team will provide the agenda and meeting minutes.
- The PWSA will provide the venue location.

E. THIRD PARTY INFORMATION

A wealth of information regarding existing subsurface conditions and utilities is available for the project area. The ability to obtain such information from their respective owners in electronic format has the potential to positively affect the project schedule. It is assumed that the PWSA will support and assist with formal requests for relevant information owned by third parties, including, but not limited to:

- PennDOT geotechnical information for SR 28 Highland Park Interchange and Route 8 Etna Interchange.
- Sharpsburg Borough combined sewer mapping and CCTV records, if available.
- Aspinwall Borough sewer & water system mapping and information.
- Etna Borough sewer system mapping & information.
- Hampton-Shaler Water system mapping (Etna & Sharpsburg)

TASK 2: FINAL DESIGN AND PERMITTING

A. SURVEYING OF PROPOSED ROUTE

- The Michael Baker Team shall utilize a combination of LIDAR technology on the preferred/approved route for initial survey efforts with convention techniques combined with SUE to provide underground information.
- Vertical Control: Twenty-two (22) benchmarks will be established throughout the survey work limits.
- Horizontal Control: One (1) control point will be established using a VRS network or an NGS OPUS solution. Other control points will be established by using an RTK set up. Datum will be PA State Plane, South Zone NAD 83 (2011) and NAVD 88. There will be forty-two (42) control points.
- SUE Services are to include preliminary coordination, PA one-calls, temporary permit applications for test holes and the following:
  - Quality Level D Research- PA One-Calls for 2 proposed alignment alternatives. Tracking of all utility requests for information and field verification of preliminary results.

- Quality Level B- Utility Designation for selected alignment only. JMT has assumed a total of 22,500 LF length of alignment with approximately 6 utilities located along the length for estimation purposes. This quantity will be confirmed only after Quality Level D Research is complete. This item will be invoiced as a linear foot cost for the amount of utilities designated.
- Quality Level A- Test Holes. 150 test holes are assumed; to be invoiced as a "per each" item for each test hole completed regardless of the location.

B. PHASE I ENVIRONMENTAL SITE ASSESSMENT

- A Phase II Environmental Assessment is not included in this scope, but an estimate can be provided if requested by the PWSA.
- The PWSA the Michael Baker Team will get approval from the Owners for Michael Baker staff to inspect the properties.
- All reports will be provided via electronic copy. No hard copies will be provided.
- Phase I ESA will be conducted in two (2) parts:
  - The initial ESA Screening to assist with the selection of the preferred route during Preliminary Design efforts; and
  - Phase I ESA Report during the Final Design
- Final deliverable will be an Environmental Site Assessment Report.

C. GEOTECHNICAL INVESTIGATION

- This scope of services does not include MICHAEL BAKER or the driller locating utilities using geophysics, hydraulic or pneumatic trenching, hand digging, or other such means or methods.
- MICHAEL BAKER assumes that the site is not contaminated and standard personal protective equipment (PPE) including safety toe boots, gloves, safety vest, and hard hats are required during drilling activities.
- The trenchless design team will conduct a one (1) day field visit.
- It is assumed that the final permanent structures to be placed in the launch and receiving pits will be precast reinforced concrete structures designed by the manufacturer and submitted for review during construction

D. EVALUATION OF PIPE MATERIAL AND PRESSURE CLASS

- Transient and surge analysis will only be completed on selected alignment.
- Hydraulic model results will include recommendations for surge, pipe material, valve spacing, and air release valve sizing.
- The finalized model will be delivered to the PWSA in conjunction with the submittal of the model report.

E. PIPELINE PLANS AND DETAILS

- Any Municipal water main connection to the proposed alignment will be contained to within ten (10) feet of the centerline of the pipe.
- No post-Construction stormwater management plans will be completed.
- No remediation efforts for environmental, archeological, or historic issues are included
- Final Design will not include combined sewer separation.
- GSI design will not be included in the site restoration efforts. Restoration will limited to matching existing conditions prior to the project commencement.
- The Michael Baker Team will provide technical specifications only (Construction Specifications Institute MasterFormat 2004. The PWSA will provide Division 00 and 01 Specifications.

- Street tree plans are not included in this proposal.
- Relocation of laterals and utility transmission lines is not included in this project.
- Plans will include:
  - No more than horizontal 1" = 20' scale and a vertical 1" = 5' scale.
  - Maximum of four (4) Trenchless Crossing plan and profile sheets and eight (8) cross sections at critical locations along the trenchless portion of the project.
  - Cross Sections every 50 feet.

- 30% Preliminary Design Phase
  - 30% Geotechnical Investigations
  - The PWSA will have 35 business days to review the 30% Design submission
- 60% Design Phase
  - 60% Geotechnical Investigations
  - The PWSA will have 20 business days to review the 60% Design submission

- 90% Design Phase
  - 90% Geotechnical Investigations
  - The PWSA will have 15 business days to review the 90% Design submission

- 100% Design Phase/Bid Ready
  - 100% Geotechnical Investigations

F. MEETINGS

- Meetings will take place at the PWSA Office
- One (1) Project Kickoff
- Monthly Project Status – no more than twelve (12) meetings during the design phase
- One (1) 30% Design Review Meeting
- One (1) 60% Design Review Meeting
- One (1) 90% Design Review Meeting
- One (1) Final Design Review Meeting
- One (1) Meeting with the PWSA and PaDEP
- Maximum three (3) Meetings with Stakeholders
- One (1) Meeting each with Shaler Township, Etna Borough, Aspinwall, Sharpsburg, CoP at Preliminary Design
- One (1) Meeting each with Shaler Township, Etna Borough, Aspinwall, Sharpsburg, CoP at post 30% Design
- One (1) Meeting each with Shaler Township, Etna Borough, Aspinwall, Sharpsburg, CoP at post 90% Design
- One (1) Meeting each with the Utilities/Railroad
- Two (2) Public Meetings

- The Michael Baker Team will provide the agenda and meeting minutes.
- The PWSA will provide the venue location for public meetings.

G. TRAFFIC CONTROL PLANS

- The Traffic Control approach based on the preferred alignment provided in the RFP documents.
  - A revised alignment using other local roads of similar length will be the same effort.
  - A revised alignment using a longer route may require more individual block detours.
  - A revised alignment using Freeport Road or another major roadway will likely require phased construction. This will require a supplement as phased construction will require additional design effort.
- The Traffic Control approach assumes that short duration detours will be acceptable for local streets. Separate vehicular and pedestrian detours will be created. Detours will be based on entire block lengths and will not be broken at alleys. Pedestrian detours will utilize the most convenient route, which may or may not be ADA accessible. No scope is included to make the detour routes ADA accessible since only short duration detours are anticipated.
- Plans will be created to the detail of a PennDOT plan set. Maintaining individual property access will not be explicitly shown but will be the responsibility of the contractor.

H. PERMITTING

- Permits will be identified during the preliminary design phase of the project.
- The Michael Baker Team (and the PWSA) will hold one (1) pre-submittal meeting with each of the agencies to discuss the layout and to go over all concerns and questions.

I. EASEMENTS

- The Michael Baker Team will obtain copies of tax maps, assessment sheets, deeds, adverses/exceptions, utility easements and recorded lot plans for properties within the project limits. When deed descriptions are vague or lacking information, Monaloh will obtain copies of the prior deeds. All information will be provided to Baker in digital format. Estimate six hundred nine (609) parcels.
- Estimate sixty (60) roads and two (2) railroads to research
- A property exhibit and legal description will be prepared. The property exhibit will include the following:
  - Property lines
  - Bearings and Distances
  - Proposed easement lines
  - Easement areas
  - PLS seal & signature
- It is anticipated that there will be fifteen (15) property exhibits

J. MUNICIPAL/PUBLIC COORDINATION

- There will be five (5) meetings, two (2) hours each including two (2) Michael Baker Team members
- Utility coordination ends at the conclusion of the Final Design Task.
- Michael Baker Team will be responsible for the agendas and meeting minutes

K. CONTRACT DOCUMENTS

- The proposal is based upon preparation of contract documents for a single contract.

L. PROJECT COORDINATION

- There will be five (5) meetings, two (2) hours each including two (2) Michael Baker Team members for the PWSA CIP coordination meetings with the PWSA and other consultants at the PWSA office.

TASK 3: BIDDING PHASE SERVICES

A. BIDDING PHASE

- The Michael Baker Team shall participate in one (1) pre-bid meeting
- Michael Baker Team will be responsible for the agenda and meeting minutes

TASK 4: CONSTRUCTION PHASE COORDINATION

A. CONSTRUCTION ACTIVITIES

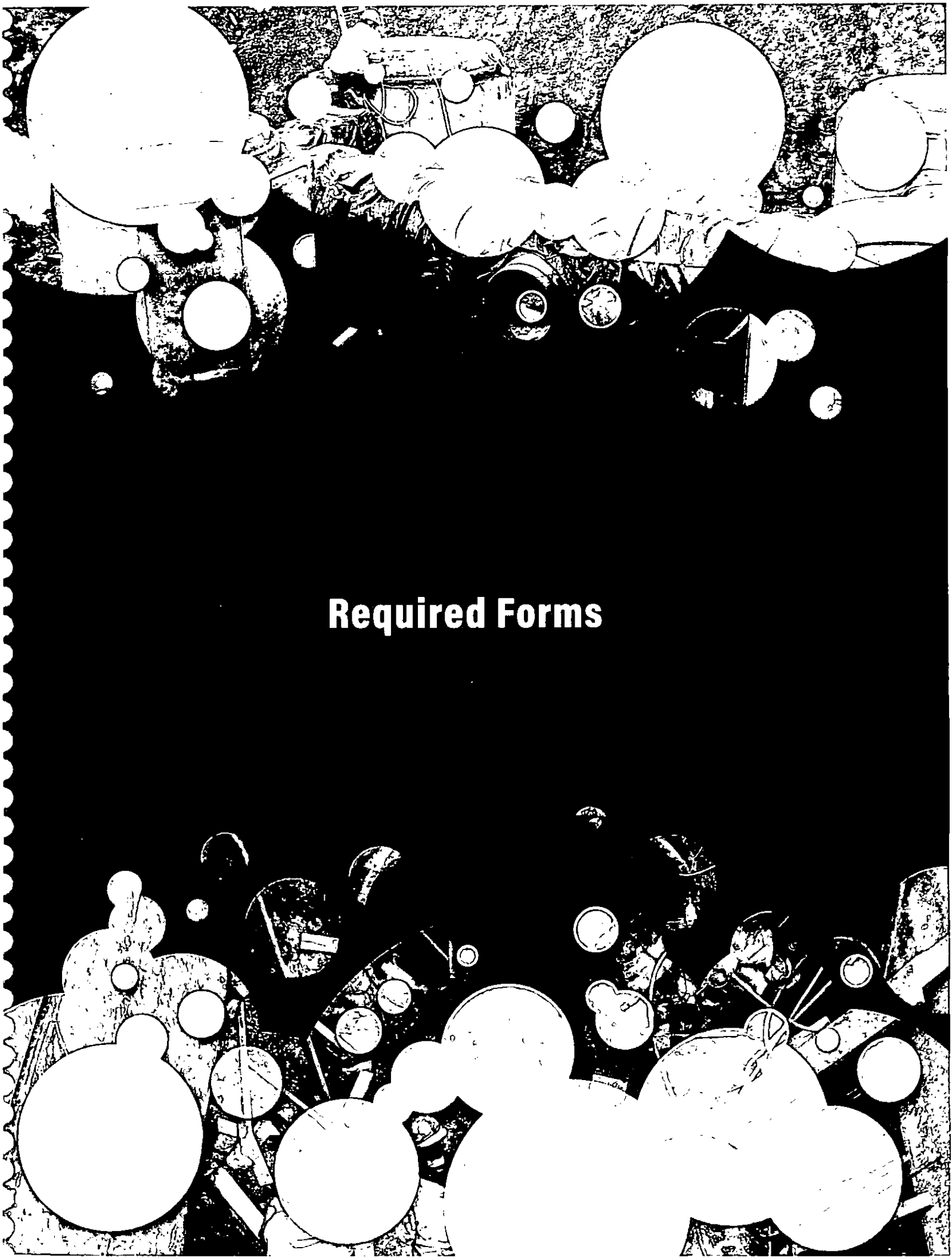
- Michael Baker will not provide means and methods for construction including sheeting and shoring.
- Michael Baker will provide not structure evaluation prior to or after construction.
- Construction phase surveying is not included in this proposal.
- 24 Site Visits – two (2) visits per month.
- Michael Baker will attend one (1) progress meeting per month with no more than twenty-four (24) meetings.

B. SUBMITTALS

- The Michael Baker Team shall review up to 40 submittals for the project materials and related items for approval.
- The Michael Baker Team will not create shop drawings for any of the design items.
- Submittals will be reviewed and returned within 5 working days of receipt
- Michael Baker assumes the PWSA will initially review all submissions for general conformity to PWSA standards prior to issuing to Michael Baker for review

C. REQUESTS FOR INFORMATION (RFI)

- The Michael Baker Team shall review up to 60 RFIs regarding the project documents throughout the construction process
- RFIs will be reviewed and addressed within 7 business days of receipt



Required Forms

Request for Proposals for the

Aspinwall Pump Station to Lanpher Reservoir Rising Main

PWSA PROJECT NO. 2018-323-100-0

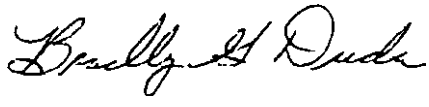
ADDENDA ACKNOWLEDGEMENT FORM

Addendum No 1 received: August 21, 2018
Addendum No 2 received: August 31, 2018

for Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main
PWSA PROJECT NO. 2018-323-100-0

BIDDER'S COMPANY NAME:

Michael Baker International, Inc.



Signature:

Printed name: **Brad Duda, PE**

***Identify all addenda by number and date**

Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main
PWSA PROJECT NO. 2018-323-100-0

SIGNATURE PAGE

The following documents which are included in the Invitation for Bids/Request for Proposals shall be incorporated in the resulting Contract by reference and shall become a part of said Contract:

N/A

Submission of the Bid/Proposal shall be considered as prima facie evidence that the Bidder/Offeror has familiarized him/herself with and understands the conditions under which the Contract shall be awarded, performed, and administered.

Name of Bidder/Offeror must be shown in full if an individual; and if a partnership, full names of all partners must be show. If Bidder/Offeror is a corporation, impress corporate seal and furnish name of state where incorporated. If joint venture, all parties must sign.

Bidder/Offeror represents that his/her firm does business as (Check one):

_____ an individual

_____ a joint venture

_____ a partnership

X a corporation

The Bidder/Offeror hereby agrees that if accepted by the Authority, he/she will well and faithfully perform as specified.

Incorporated in the State of **Pennsylvania**	Firm's Telephone No.: **412-269-6300 (Moon Township)**
Accepted this date _____	E-mail Address: **William.Almes@mbakerintl.com**
THE PITTSBURGH WATER & SEWER AUTHORITY:	Name of Bidder/Offeror (type or print) **Michael Baker International, Inc.**
_____ Signature/Executive Director	_____ Signature
WITNESS:	Printed Name and Title **William Almes, PE | Practice Executive, Civil & Environmental**
_____ Signature	
_____ Printed Name and Title	Business address (type or print) **Headquarters Office** **500 Grant Street, Suite 5400, Pittsburgh, PA 15219**
Approved as to form:	WITNESS/ATTEST: Terri A Vojnovich
_____ Legal Counsel for Authority	Signature TERRI A. VOJNOVICH, Asst. Sec.
Authorizing Agenda Item No.:_____ of 20____	Printed Name and Title

Request for Proposals
Aspinwall Pump Station to Lanpher Reservoir Rising Main
PWSA PROJECT NO. 2018-323-100-0

REFERENCE FORM

1. A. Name and address of customer:

Pennsylvania Department of Transportation, District 11-0
45 Thoms Run Road
Bridgeville, PA 15017

B. Name, title, telephone number, and e-mail of customer contact.

Name: **Cheryl Moon-Sirianni**

Title: **District Executive for District 11**

Telephone Number: **412.429.5005**

E-mail: **csirianni@state.pa.us**

C. Description of work performed.

Michael Baker provided engineering services for the extensive utility relocations that were required for the preliminary and final design for the reconstruction of S.R. 28 (East Ohio Street), from downtown Pittsburgh to Millvale. Michael Baker's services included record research; field investigations; utility surveying and mapping; three-dimensional modeling; utility coordination; and relocation design of water and sewer infrastructure and coordination of electric, telephone, and cable television utilities.

Contract title: **S.R. 28 Utility Relocation Design**

Contract dates: **6/2007 – 8/2017**

Cost: **$2,994,430 (fee)**

2. A. Name and address of customer:

Allegheny County Sanitary (ALCOSAN) Authority
3300 Preble Avenue
Pittsburgh, PA 15233

B. Name, title, telephone number, and e-mail of customer contact.

Name: **Milton Lenhart**

Title: **Project Manager**

Telephone Number: **412.734.6259**

E-mail: **milton.lenhart@alcosan.com**

C. Description of work performed.

Michael Baker provided engineering and environmental services for the design of a 60-inch-diameter storm sewer to remove the Pine Hollow Run and Deweyville Run storm flows from the interceptor system. Michael Baker conducted hydraulic and hydrologic analyses, developed erosion and sedimentation control and right-of-way plans, prepared permit applications, verified utility service line locations, developed the storm sewer line alignment and system design specifications, and prepared traffic control and construction sequencing plans.

Contract title: **Pine Hollow Storm Sewer Engineering & Environmental Services**

Contract dates: **6/2009 – 10/2013**

Cost: **$1,400,000 (construction); $665,000 (fee)**

3. A. Name and address of customer:

Sports and Exhibition Authority of Pittsburgh and Allegheny County
425 Sixth Avenue, Suite 2750
Pittsburgh, PA 15219

B. Name, title, telephone number, and e-mail of customer contact.

Name: **Doug Straley**

Title: **Project Executive**

Telephone Number: **412.393.0207**

E-mail: **dstraley@pgh-sea.com**

C. Description of work performed.

Michael Baker provided full-service site civil, transportation and sustainable infrastructure design and engineering for the Lower Hill Redevelopment Site, a 28-acre parcel situated adjacent to Downtown Pittsburgh on the land formerly occupied by the Pittsburgh Civic Arena. The parcel is controlled by the Sports and Exhibition Authority of Pittsburgh and Allegheny County (SEA) and the development rights are held by the Pittsburgh Penguins.

Contract title: **Lower Hill Redevelopment Site Sustainability Design**

Contract dates: **3/2012 – 10/2017**

Cost: **$15,000,000 (construction); $1,890,000 (fee)**

Exh. RAW/C-18

Michael Baker
INTERNATIONAL

We Make a Difference

October 31, 2018

Pittsburgh Water and Sewer Authority
1200 Penn Avenue, 2nd Floor
Pittsburgh, PA 15222

Attn: Ms. Nicole Dickun, Procurement Manager

Subject: Aspinwall Pump Station to Lanpher Reservoir Rising Main Project

Dear Ms. Dickun,

Michael Baker International, Inc. sincerely appreciated the opportunity to present our qualifications for the Aspinwall Pump Station to Lanpher Reservoir Rising Main project. As a follow up to our presentation, you requested a Best and Final Offer in consideration of the following:

1. The possibility of having multiple construction contracts
2. Schedule (Please revisit your schedule and revise as necessary)

We have reconvened the design team and thoroughly reviewed all aspects of the project related to the two subject items in your request. The following is a brief synopsis of our discussions that have gone into preparation of our Best and Final Offer:

Multiple Construction Contracts

There was interesting and robust discussion about the pros and cons of multiple construction contracts during the presentation. The anticipated contract value of this waterline project greatly eclipses the typical values of routine PWSA waterline contracts, so the discussion was warranted and very valuable. We offer the following to supplement and recap the discussions, as well as our response:

Pros of Multiple Construction Contracts

- Ability to significantly expedite the construction schedule with multiple contractor crews.
- Lower contract values encourage local (smaller) contractor participation.
- Increased competition due to attraction of more local bidders, both large and small.
- Attracting local contractors will generally include those familiar with PWSA construction procedures.

Cons of Multiple Construction Contracts

- Duplication of contractor line item costs for bonding, insurance, administrative efforts, etc.
- Increase the administrative effort of PWSA, the construction manager, construction inspector, etc.
- Coordination at the construction interface point(s) between contracts.
- Minimal increase in design and bid phase services costs to accommodate multiple contract packages.

100 Airside Drive | Moon Township, PA 15108
Office: 412.269.6300 | Fax: 412.375.3995

We offer the following contrast with regards to a single construction contract:

Pros of Single Construction Contract

- Single point of responsibility for entire project and no interface coordination point(s).
- No duplication of bonding, insurance, administrative costs on the contractor's part.
- Administrative costs for construction management, inspection, etc. are streamlined.
- Potentially lower unit costs due to larger item quantities.

Cons of Single Construction Contracts

- High contract value may exclude local firms as prime contractors due to bonding limits, equipment availability, manpower, etc.
- High contract value may encourage larger firms not familiar with the geographic area, project stakeholders, PWSA standards, etc.
- Contractor must show ability to staff/run multiple crews to maintain desired completion date.
- Success requires a contractor supervisory staff that is familiar with work of this magnitude.

Regardless of the decision made regarding multiple contracts, it is our opinion that the design and permitting be conducted as a single package with attention being paid to sensible break points between construction contracts if the decision to award multiple contracts is made. With the project being totally linear in nature, separating the design plans and specifications into multiple packages is not overburdensome.

Schedule Considerations

There was discussion about the project design schedule at the presentation, and it is our understanding that PWSA desires to expedite the overall schedule as much as reasonably possible. Given the critical nature of this proposed utility, our project team has reviewed all schedule input parameters and we offer the following considerations.

- During the presentation, our team discussed significant areas within the project limits where we have overlap with existing current major PennDOT projects. The ability to utilize current information that has been generated and verified by Baker for these projects can have significant schedule and cost reduction effects on the PWSA project. Baker has confirmed through PennDOT that this information, including, but not limited to, base mapping, utility information, surveys, sewer CCTV data, etc. can be utilized by Baker on this project with a simple data sharing letter of request to PennDOT from PWSA.
- In consideration of PWSA's enhanced working relationship with PADEP, the durations for construction permit review and approval have been adjusted.
- Opportunities to engage additional personnel from our Pittsburgh based staff were reviewed and some durations have been shortened accordingly.
- Opportunities to create task overlaps were identified and some task items will be performed concurrently rather than in a more linear fashion.
- The amended schedule included herein represents realistic lead durations, and our team will strive to meet and exceed all milestones to allow the construction phase to have the "float" time as opposed to the design phase. During design and alignment selection, the team will look for opportunities to streamline trenchless construction installation that can greatly reduce construction durations and cost for the PWSA.

The presentation was an excellent forum for our team to better understand PWSA's concerns in executing this design and construction project. Similarly, the engagement with staff enabled us to share our thoughts on some of these critical items based on our experience on other local large-scale pipeline projects in the Pittsburgh area.

In consideration of the above, we are pleased to present PWSA with our Best and Final Offer as well as a revised schedule.

If you have any questions, please feel free to contact me at 412-269-6060 or bduda@mbakerintl.com.

Sincerely,

MICHAEL BAKER INTERNATIONAL, INC.

Bradley G. Duda, P.E.
Project Manager

BD:bgd

Attachments

Michael Baker
INTERNATIONAL

BASE PRICE PROPOSAL SUMMARY FOR PROFESSIONAL SERVICES FOR PROFESSIONAL SERVICES FOR ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN		
TASK DESCRIPTION	**SUBTOTAL**	**TOTAL**
TASK NO. 1 PRELIMINARY DESIGN REPORT	$459,091	
TASK NO. 2 FINAL DESIGN AND PERMITTING	$3,596,504	
TASK NO. 3: BIDDING PHASE SERVICES	$47,533	
TASK NO. 4: COORDINATION DURING CONSTRUCTION	$554,960	
Michael Baker is committed to achieving the 30% overall MBE/WBE/SDVOBE goal.	**TOTAL PRICE:**	**$4,658,090**

PITTSBURGH WATER AND SEWER AUTHORITY

PROFESSIONAL SERVICES FOR ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN
TASK NO. 1 PRELIMINARY DESIGN REPORT

PART I - GENERAL

1. Project Name: Aspinwall Pump Station to Lanpher Reservoir Rising Main		**2. Project No:**	PWSA
3. Name of Contractor or Subcontractor:	Michael Baker International, Inc.	**4. Date of Proposal:**	September 18, 2018
5. Address of Contractor or Subcontractor:	500 Grant Street, Suite 5400 Pittsburgh, PA 15219	**6. Type of Service to be Furnished:**	Engineering

PART II - COST SUMMARY

7. Direct Labor (Specify Categories)	**Est. Hours**	**Hr. Rate**	**Est. Cost**	Totals
Program Manager	72	$90.00	$6,480	
Technical Manager	120	$68.87	$8,264	
Engineer	288	$50.71	$14,604	
Senior Engineer	440	$58.24	$25,626	
Junior Engineer	384	$37.56	$14,423	
Senior Designer	0	$49.27	$0	
GIT Assoc./Civil Assoc.	460	$27.69	$12,737	
Civil Associate II	0	$31.82	$0	
Designer	0	$30.24	$0	
Survey Manager	40	$42.50	$1,700	
Secretary	16	$30.43	$487	
			Total Direct Labor Costs:	**$84,322**
8. Indirect Costs (Specify Cost Pools)	**Rate**	**x Base =**	**Est. Cost**	
2015 Audited Overhead	155.69%	$84,322	$131,281	
			Total Indirect Costs:	**$131,281**
9. Other Direct Costs				
a. Travel			Est. Cost	
(1) Transportation			$0	
(2) Mileage			$0	
		Travel Subtotal:	$0	
b. Equipment, Materials, Supplies (Specify Categories)	Qty.	Unit Cost	Est. Cost	
Drawings (Full Size)	200	$2.00	$400.00	
Color Copies	100	$0.10	$10.00	
Copies	500	$0.05	$25.00	
CDs		$1.00	$0.00	
Color Presentation Boards		$40.00	$0.00	
Color Presentation Boards	0	$40.00	$0.00	
LIDAR (Lump Sum ODC)	1	$10,117.34	$10,117.34	
		Equipment Subtotal:	$10,552	
c. Subcontracts			Est. Cost	
JMT			$200,000	
Sci-Tek			$20,000	
		Subcontract Subtotal (including 5% markup):	$220,000	
d. Other (Specify Categories)			Est. Cost	
		Other Subtotal:	$0	
			Total Other Direct Costs:	**$230,552**
10. Total Estimated Cost				**$446,155**
11. Profit (not including ODC's and Subs)			6%	**$12,936**
12. Total Price				**$459,091**

PITTSBURGH WATER AND SEWER AUTHORITY

PROFESSIONAL SERVICES FOR ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN
TASK NO. 2 FINAL DESIGN AND PERMITTING

PART I - GENERAL

1. Project Name: Aspinwall Pump Station to Lanpher Reservoir Rising Main		**2. Project No:**	**PWSA**
3. Name of Contractor or Subcontractor:	**Michael Baker International, Inc.**	**4. Date of Proposal:**	**September 18, 2018**
5. Address of Contractor or Subcontractor:	**500 Grant Street, Suite 5400 Pittsburgh, PA 15219**	**6. Type of Service to be Furnished:**	**Engineering**

PART II - COST SUMMARY

7. Direct Labor (Specify Categories)	**Est. Hours**	**Hr. Rate**	**Est. Cost**	Totals
Program Manager	88	$90.00	$7,920	
Technical Manager	332	$68.87	$22,865	
Engineer	1,306	$50.71	$66,227	
Senior Engineer	1,852	$58.24	$107,860	
Junior Engineer	1,860	$37.56	$69,862	
Senior Designer	1,833	$49.27	$90,312	
GIT Assoc./Civil Assoc.	964	$27.69	$26,693	
Civil Associate II	316	$31.82	$10,055	
Designer	4,250	$30.24	$128,520	
Secretary	48	$30.43	$1,461	
			Total Direct Labor Costs:	**$558,975**
8. Indirect Costs (Specify Cost Pools)	**Rate**	**x Base =**	**Est. Cost**	
2015 Audited Overhead	155.69%	$558,975	$870,268	
			Total Indirect Costs:	**$870,268**
9. Other Direct Costs				
a. Travel			Est. Cost	
(1) Transportation (Survey Crew)			$0	
(2) Mileage			$0	
		Travel Subtotal:	$0	
b. Equipment, Materials, Supplies (Specify Categories)	Qty.	Unit Cost	Est. Cost	
Drawings (Full Size)	1,200	$2.00	$2,400.00	
Color Copies	500	$0.10	$50.00	
Copies	2,000	$0.05	$100.00	
CDs		$1.00	$0.00	
Color Presentation Boards		$40.00	$0.00	
Shipping (Overnight)		$50.00	$0.00	
Mylar copies		$10.00	$0.00	
Envelopes/Letters/Stamps	0	$0.00	$0.00	
		Equipment Subtotal:	$2,550	
c. Subcontracts			Est. Cost	
JMT			$490,000	
ESA			$200,000	
K. Brean			$30,000	
Manoloh Basin Engineers			$354,197	
Sci-Tek			$225,000	
Ackenheil			$45,000	
AWK			$200,000	
Cosmos			$100,000	
McMJacobs			$159,759	
Robinson Pipe			$275,000	
		Subcontract Subtotal (including 5% markup):	$2,078,956	
d. Other (Specify Categories)			Est. Cost	
		Other Subtotal:	$0	
			Total Other Direct Costs:	**$2,081,506**
10. Total Estimated Cost				**$3,510,749**
11. Profit (not including ODC's and Subs)			6%	**$85,755**
12. Total Price				**$3,596,504**

PITTSBURGH WATER AND SEWER AUTHORITY

PROFESSIONAL SERVICES FOR ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN
TASK NO. 3: BIDDING PHASE SERVICES

PART I - GENERAL

1. Project Name: Aspinwall Pump Station to Lanpher Reservoir Rising Main		**2. Project No:**	**PWSA**
3. Name of Contractor or Subcontractor:	**Michael Baker International, Inc.**	**4. Date of Proposal:**	**September 18, 2018**
5. Address of Contractor or Subcontractor:	**500 Grant Street, Suite 5400 Pittsburgh, PA 15219**	**6. Type of Service to be Furnished:**	**Engineering**

PART II - COST SUMMARY

7. Direct Labor (Specify Categories)	**Est. Hours**	**Hr. Rate**	**Est. Cost**	Totals
Program Manager	12	$90.00	$1,080	
Technical Manager	0	$68.87	$0	
Engineer	96	$50.71	$4,868	
Senior Engineer	160	$58.24	$9,318	
Junior Engineer	56	$37.56	$2,103	
Senior Designer	0	$49.27	$0	
GIT Assoc./Civil Assoc.	0	$27.69	$0	
Civil Associate II	0	$31.82	$0	
Designer	0	$30.24	$0	
Secretary	0	$30.43	$0	
			Total Direct Labor Costs:	**$17,370**
8. Indirect Costs (Specify Cost Pools)	**Rate**	**x Base =**	**Est. Cost**	
2015 Audited Overhead	155.69%	$17,370	$27,043	
			Total Indirect Costs:	**$27,043**
9. Other Direct Costs				
a. Travel			Est. Cost	
(1) Transportation			$0	
(2) Mileage			$0	
		Travel Subtotal:	$0	
b. Equipment, Materials, Supplies (Specify Categories)	Qty.	Unit Cost	Est. Cost	
Drawings (Full Size)	200	$2.00	$400.00	
Color Copies	50	$0.10	$5.00	
Copies	1,000	$0.05	$50.00	
CDs		$1.00	$0.00	
Color Presentation Boards		$40.00	$0.00	
Shipping (Overnight)		$50.00	$0.00	
Mylar copies		$10.00	$0.00	
Envelopes/Letters/Stamps	0	$0.00	$0.00	
		Equipment Subtotal:	$455	
c. Subcontracts			Est. Cost	
			$0	
			$0	
			$0	
			$0	
		Subcontract Subtotal (including 5% markup):	$0	
d. Other (Specify Categories)			Est. Cost	
		Other Subtotal:	$0	
			Total Other Direct Costs:	**$455**
10. Total Estimated Cost				**$44,868**
11. Profit (not including ODC's and Subs)			6%	**$2,665**
12. Total Price				**$47,533**

PITTSBURGH WATER AND SEWER AUTHORITY

PROFESSIONAL SERVICES FOR ASPINWALL PUMP STATION TO LANPHER RESERVOIR RISING MAIN
TASK NO. 4: COORDINATION DURING CONSTRUCTION

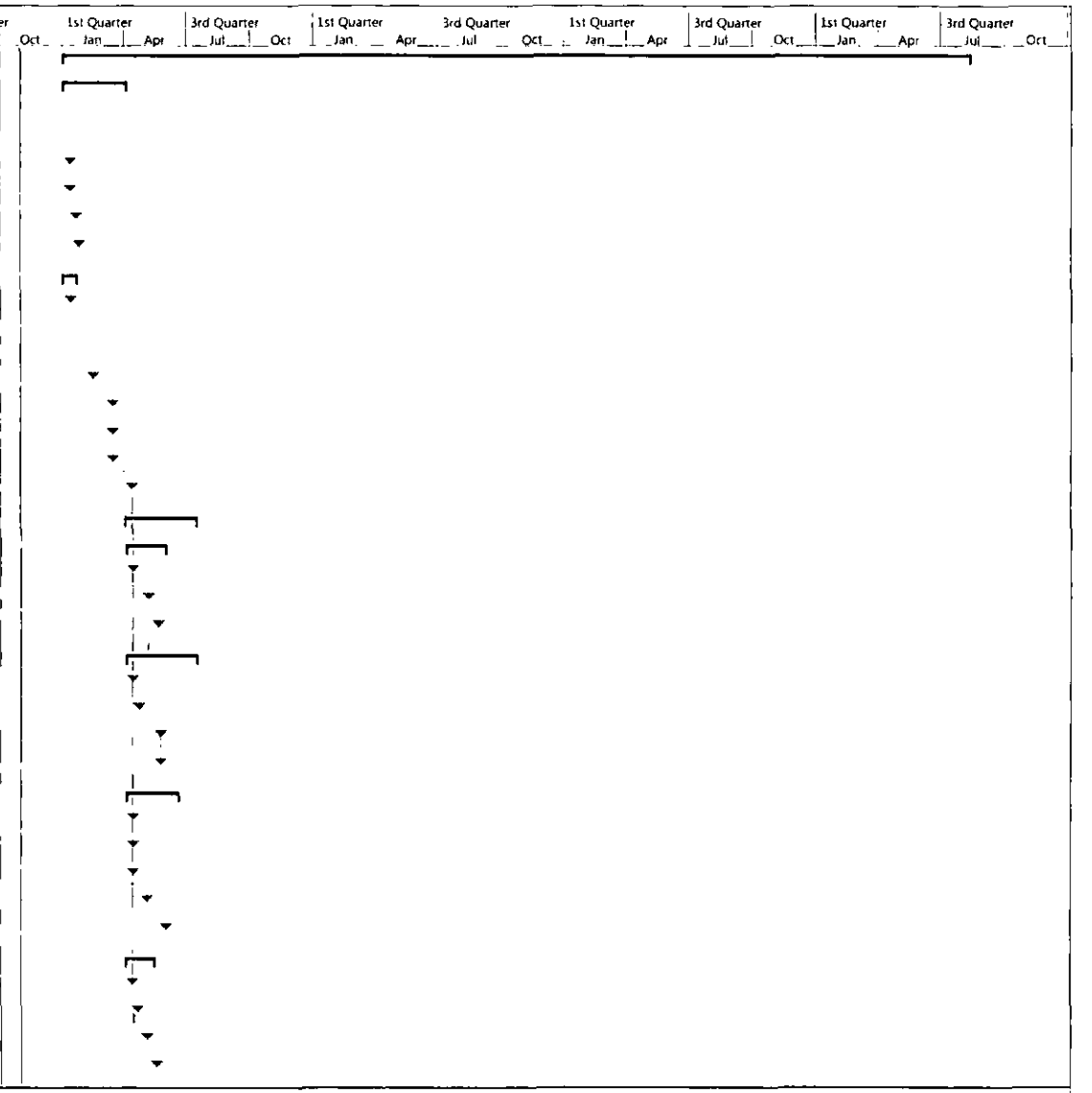
PART I - GENERAL

1. Project Name: Aspinwall Pump Station to Lanpher Reservoir Rising Main		**2. Project No:**	**PWSA**
3. Name of Contractor or Subcontractor:	**Michael Baker International, Inc.**	**4. Date of Proposal:**	**September 18, 2018**
5. Address of Contractor or Subcontractor:	**500 Grant Street, Suite 5400 Pittsburgh, PA 15219**	**6. Type of Service to be Furnished:**	**Engineering**

PART II - COST SUMMARY

7. Direct Labor (Specify Categories)	**Est. Hours**	**Hr. Rate**	**Est. Cost**	Totals
Program Manager	40	$90.00	$3,600	
Technical Manager	20	$68.87	$1,377	
Engineer	554	$50.71	$28,093	
Senior Engineer	1,288	$58.24	$75,013	
Junior Engineer	608	$37.56	$22,836	
Senior Designer	0	$49.27	$0	
GIT Assoc./Civil Assoc.	0	$27.69	$0	
Civil Associate II	0	$31.82	$0	
Designer	0	$30.24	$0	
Secretary	0	$30.43	$0	
			Total Direct Labor Costs:	**$130,920**
8. Indirect Costs (Specify Cost Pools)	**Rate**	**x Base =**	**Est. Cost**	
2015 Audited Overhead	155.69%	$130,920	$203,830	
			Total Indirect Costs:	**$203,830**
9. Other Direct Costs				
a. Travel			Est. Cost	
(1) Transportation			$0	
(2) Mileage			$0	
		Travel Subtotal:	$0	
b. Equipment, Materials, Supplies (Specify Categories)	Qty.	Unit Cost	Est. Cost	
Drawings (Full Size)	50	$2.00	$100.00	
Color Copies		$0.10	$0.00	
Copies	500	$0.05	$25.00	
CDs		$1.00	$0.00	
Color Presentation Boards		$40.00	$0.00	
Shipping (Overnight)		$50.00	$0.00	
Mylar copies		$10.00	$0.00	
Envelopes/Letters/Stamps		$1.00	$0.00	
		Equipment Subtotal:	$125	
c. Subcontracts			Est. Cost	
Cosmos			$50,000	
AWK			$50,000	
McMillan Jacobs			$100,000	
		Subcontract Subtotal (including 5% markup):	$200,000	
d. Other (Specify Categories)			Est. Cost	
		Other Subtotal:	$0	
			Total Other Direct Costs:	**$200,125**
10. Total Estimated Cost				**$534,875**
11. Profit (not including ODC's and Subs)			6%	**$20,085**
12. Total Price				**$554,960**

ID	Task Name	Duration	Start	Finish
1	**Lanpher Rising Main Design**	**942 days**	**Wed 1/2/19**	**Thu 8/11/22**
2	Preliminary Design	**66 days**	**Wed 1/2/19**	**Wed 4/3/19**
3	**Notice to Proceed**	1 day	Wed 1/2/19	Wed 1/2/19
4	**Kick Off Meeting**	1 day	Wed 1/2/19	Wed 1/2/19
5	**Review 2016 Feasibility Study**	7 days	Thu 1/3/19	Fri 1/11/19
6	**Gather existing record information**	7 days	Thu 1/3/19	Fri 1/11/19
7	**Field view**	2 days	Mon 1/14/19	Tue 1/15/19
8	**Create record based Existing Conditions plan**	14 days	Wed 1/16/19	Mon 2/4/19
9	**Phase 1 Environmental Assessment Report**	**14 days**	**Wed 1/2/19**	**Mon 1/21/19**
10	Records Research	7 days	Thu 1/3/19	Fri 1/11/19
11	Field Work	14 days	Wed 1/2/19	Mon 1/21/19
12	**Preliminary Design Report**	21 days	Tue 2/5/19	Tue 3/5/19
13	**Workshop**	1 day	Wed 3/6/19	Wed 3/6/19
14	**PADEP Pre-Application Meeting**	1 day	Wed 3/6/19	Wed 3/6/19
15	**PWSA Review**	20 days	Wed 3/6/19	Tue 4/2/19
16	**Prelimlnary Design Review Meeting**	1 day	Wed 4/3/19	Wed 4/3/19
17	30% Design	**74 days**	**Wed 4/3/19**	**Mon 7/15/19**
18	**Phase 1 Environmental Assessment Report**	**41 days**	**Thu 4/4/19**	**Thu 5/30/19**
19	Historic Assesment	7 days	Thu 4/4/19	Fri 4/12/19
20	Wetland and Riparian Resources Investigation	5 days	Mon 5/6/19	Fri 5/10/19
21	ESA Report	14 days	Mon 5/13/19	Thu 5/30/19
22	**Geotech**	**73 days**	**Thu 4/4/19**	**Mon 7/15/19**
23	Clearances to drill	7 days	Thu 4/4/19	Fri 4/12/19
24	Drilling program	21 days	Mon 4/15/19	Mon 5/13/19
25	Testing	30 days	Tue 5/14/19	Mon 6/24/19
26	Report	45 days	Tue 5/14/19	Mon 7/15/19
27	**SUE**	**54 days**	**Thu 4/4/19**	**Tue 6/18/19**
28	Records Research	7 days	Thu 4/4/19	Fri 4/12/19
29	One Call	7 days	Thu 4/4/19	Fri 4/12/19
30	Field Locate	14 days	Thu 4/4/19	Tue 4/23/19
31	GPR + Non-destructive	20 days	Wed 4/24/19	Tue 5/21/19
32	Pot Hole Testing	20 days	Wed 5/22/19	Tue 6/18/19
33	**Survey**	**30 days**	**Wed 4/3/19**	**Tue 5/14/19**
34	Mobile LiDAR	5 days	Wed 4/3/19	Tue 4/9/19
35	Preliminary Survey Creation	5 days	Wed 4/10/19	Tue 4/16/19
36	Total Station Field survey	10 days	Wed 4/24/19	Tue 5/7/19
37	Final Survey Creation	5 days	Wed 5/8/19	Tue 5/14/19



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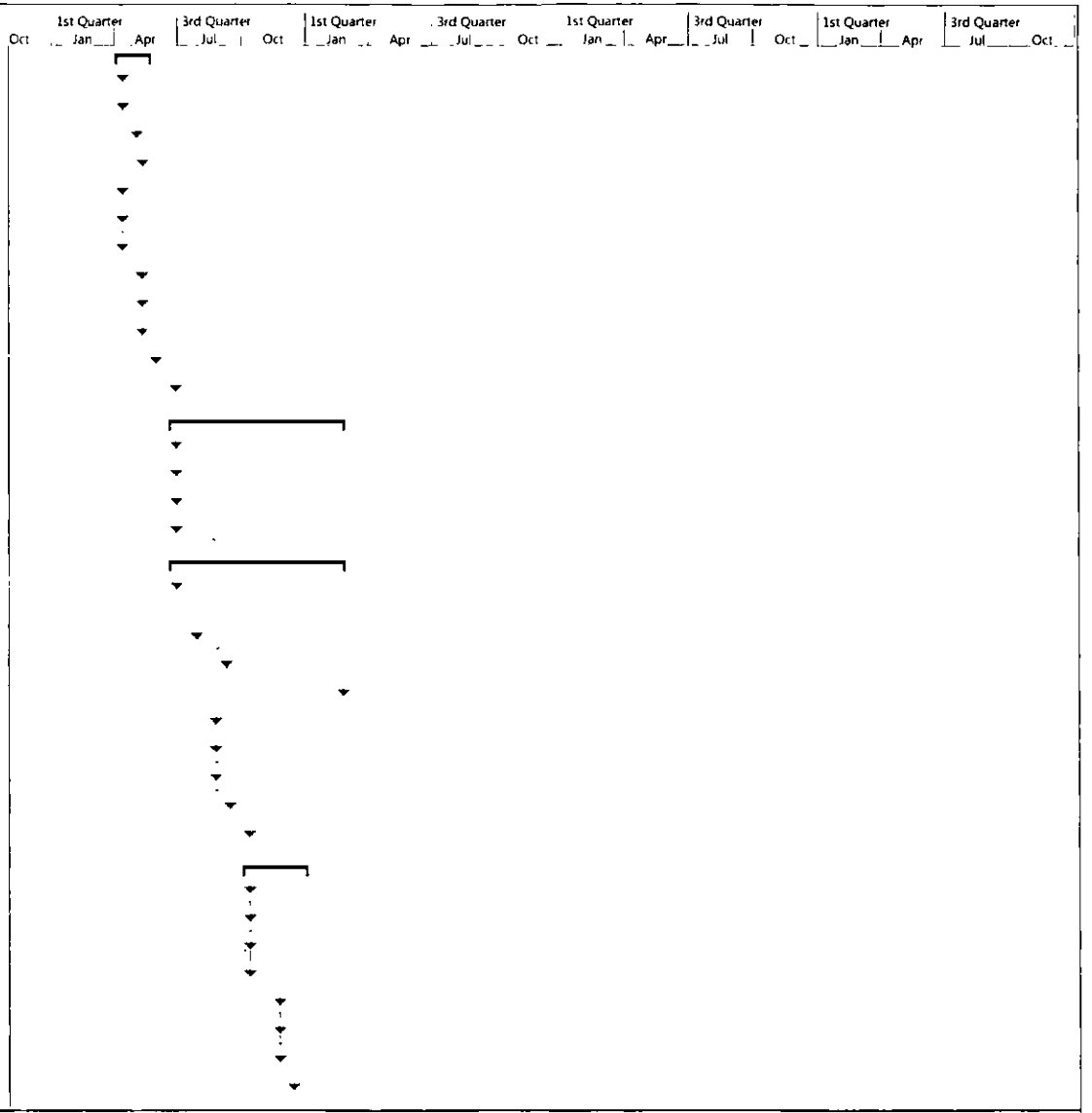
Task

Milestone ◆

ID	Task Name	Duration	Start	Finish
38	**Real Estate Services**	**35 days**	**Thu 4/4/19**	**Wed 5/22/19**
39	Deed research	14 days	Thu 4/4/19	Tue 4/23/19
40	Property research	14 days	Thu 4/4/19	Tue 4/23/19
41	Initial involved parcels determination	7 days	Wed 4/24/19	Thu 5/2/19
42	Concept easement and property take plan	14 days	Fri 5/3/19	Wed 5/22/19
43	**Specifications**	21 days	Thu 4/4/19	Thu 5/2/19
44	**MPT Plan**	14 days	Thu 4/4/19	Tue 4/23/19
45	**Rising Main Plans**	20 days	Thu 4/4/19	Wed 5/1/19
46	**Opinion of Probable Construction Cost**	7 days	Thu 5/2/19	Fri 5/10/19
47	**Value Engineering Review**	14 days	Thu 5/2/19	Tue 5/21/19
48	**Constructability Review**	14 days	Thu 5/2/19	Tue 5/21/19
49	**PWSA 30% Review**	20 days	Wed 5/22/19	Tue 6/18/19
50	**30% Design Review Meeting**	1 day	Wed 6/19/19	Wed 6/19/19
51	60% Design	**178 days**	**Thu 6/20/19**	**Mon 2/24/20**
52	**Geotechnical Report**	21 days	Thu 6/20/19	Thu 7/18/19
53	**Specifications**	30 days	Thu 6/20/19	Wed 7/31/19
54	**MPT Plan**	21 days	Thu 6/20/19	Thu 7/18/19
55	**Rising Main Plans**	40 days	Thu 6/20/19	Wed 8/14/19
56	**Real Estate Services**	**178 days**	**Thu 6/20/19**	**Mon 2/24/20**
57	Finalize parcel acquisition and easement plan	21 days	Thu 6/20/19	Thu 7/18/19
58	Finalize Legal descriptions	30 days	Fri 7/19/19	Thu 8/29/19
59	Property acquisition support	120 days	Fri 8/30/19	Thu 2/13/20
60	Record property transfer and easements	7 days	Fri 2/14/20	Mon 2/24/20
61	**Opinion of Probable Construction Cost**	7 days	Thu 8/15/19	Fri 8/23/19
62	**Value Engineering Review**	14 days	Thu 8/15/19	Tue 9/3/19
63	**Constructability Review**	14 days	Thu 8/15/19	Tue 9/3/19
64	**PWSA 60% Review**	20 days	Wed 9/4/19	Tue 10/1/19
65	**60% Design Review Meeting**	1 day	Wed 10/2/19	Wed 10/2/19
66	90% Design	**65 days**	**Thu 10/3/19**	**Wed 1/1/20**
67	**Geotechncial**	7 days	Thu 10/3/19	Fri 10/11/19
68	**Specifications**	14 days	Thu 10/3/19	Tue 10/22/19
69	**MPT Plan**	7 days	Thu 10/3/19	Fri 10/11/19
70	**Rising Main Plans**	30 days	Thu 10/3/19	Wed 11/13/19
71	**Opinion of Probable Construction Cost**	7 days	Thu 11/14/19	Fri 11/22/19
72	**Value Engineering Review**	14 days	Thu 11/14/19	Tue 12/3/19
73	**Constructability Review**	14 days	Thu 11/14/19	Tue 12/3/19
74	**PWSA 90% Review**	20 days	Wed 12/4/19	Tue 12/31/19



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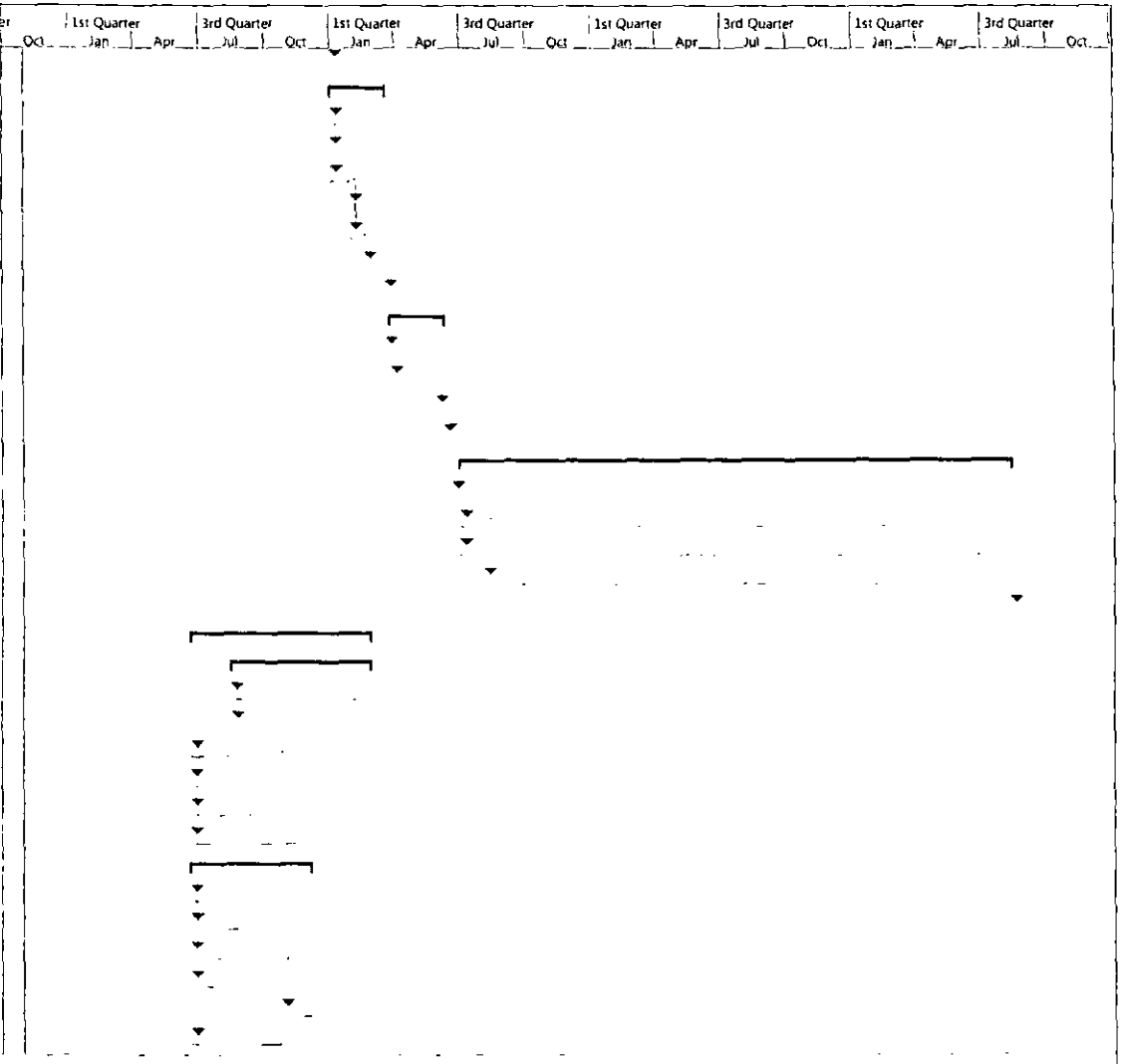
Milestone ◆

ID	Task Name	Duration	Start	Finish
75	**90% Design Review Meeting**	1 day	Wed 1/1/20	Wed 1/1/20
76	100% Design	**55 days**	**Thu 1/2/20**	**Wed 3/18/20**
77	**Specifications**	7 days	Thu 1/2/20	Fri 1/10/20
78	**MPT Plan**	7 days	Thu 1/2/20	Fri 1/10/20
79	**Rising Main Plans**	20 days	Thu 1/2/20	Wed 1/29/20
80	**Opinion of Probable Construction Cost**	7 days	Thu 1/30/20	Fri 2/7/20
81	**Constructability Review**	14 days	Thu 1/30/20	Tue 2/18/20
82	**PWSA 100% Review**	20 days	Wed 2/19/20	Tue 3/17/20
83	**100% Design Review Meeting**	1 day	Wed 3/18/20	Wed 3/18/20
84	Bid Phase Services	**54 days**	**Thu 3/26/20**	**Tue 6/9/20**
85	**Pre-Bid Meeting**	1 day	Thu 3/26/20	Thu 3/26/20
86	**Contractor RFI Response**	45 days	Fri 3/27/20	Thu 5/28/20
87	**Bid Review**	7 days	Fri 5/29/20	Mon 6/8/20
88	**Award Recommendation**	1 day	Tue 6/9/20	Tue 6/9/20
89	Construction Phase Services	**553 days**	**Tue 6/30/20**	**Thu 8/11/22**
90	**Pre-Construction Meeting**	1 day	Tue 6/30/20	Tue 6/30/20
91	**Submittal Reviews**	520 days	Wed 7/1/20	Tue 6/28/22
92	**RFI Reviews**	520 days	Wed 7/1/20	Tue 6/28/22
93	**Site Visits**	520 days	Wed 8/12/20	Tue 8/9/22
94	**Punch List**	2 days	Wed 8/10/22	Thu 8/11/22
95	Permitting	**180 days**	**Thu 6/20/19**	**Wed 2/26/20**
96	**PADEP Permitting**	**140 days**	**Thu 8/15/19**	**Wed 2/26/20**
97	Water Distribution System	140 days	Thu 8/15/19	Wed 2/26/20
98	Safe Drinking Water	60 days	Mon 8/26/19	Fri 11/15/19
99	**ACCD Permitting**	90 days	Thu 6/20/19	Wed 10/23/19
100	**Municipal Permits**	90 days	Thu 6/20/19	Wed 10/23/19
101	**PennDOT Highway Occupancy Permit**	60 days	Thu 6/20/19	Wed 9/11/19
102	**CSX Right of Way & Utility Permit**	180 days	Thu 6/20/19	Wed 2/26/20
103	**Pittsburgh DPW/DOMI Permits**	**120 days**	**Thu 6/20/19**	**Wed 12/4/19**
104	Roadway Opening Permit	90 days	Thu 6/20/19	Wed 10/23/19
105	Traffic Obstruction Permit	90 days	Thu 6/20/19	Wed 10/23/19
106	Land Operations Permit	120 days	Thu 6/20/19	Wed 12/4/19
107	Encroachment Permit	90 days	Thu 6/20/19	Wed 10/23/19
108	Stormwater Concurance	30 days	Thu 10/24/19	Wed 12/4/19
109	**Army Corps of Engineers**	90 days	Thu 6/20/19	Wed 10/23/19



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Milestone

Exh. RAW/C-19

PROFESSIONAL SERVICES AGREEMENT

THIS PROFESSIONAL SERVICES AGREEMENT ("Agreement") is made this 18th day of January 2019, by and between THE PITTSBURGH WATER AND SEWER AUTHORITY, a body corporate and politic organized and existing under the laws of the Commonwealth of Pennsylvania (the "Authority"), and MICHAEL BAKER INTERNATIONAL, INC., a Pennsylvania corporation ("Consultant"). The Authority and Consultant hereinafter called the "Party" and/or the "Parties."

WHEREAS, consistent with the Authority's Request for Proposal issued for the Aspinwall Pump Station to Lanpher Reservoir Rising Main PWSA Project No. 2018-323-100-0, the Authority is seeking a firm to provide professional engineering design and construction engineering phase services to assist the Authority as part of the construction of a rising main from the Aspinwall Pump Station to Lanpher Reservoir; and

WHEREAS, Consultant represents that it possesses the requisite professional engineering experience, skills and abilities required to perform the services contemplated by this Agreement; and

WHEREAS, Consultant has the necessary facilities, resources and staff to provide the professional engineering services to the Authority contemplated in this Agreement; and

WHEREAS, the Authority desires to engage Consultant upon the terms and conditions hereinafter set forth, and Consultant is willing to accept such engagement upon such terms and conditions.

NOW, THEREFORE, in consideration of the mutual premises and intending to be legally bound hereby, the Parties agree as follows:

1. **Incorporation of Recitals.** The foregoing recitals are incorporated herein by reference.

2. **Scope of Services.**

2.1 The Authority hereby engages Consultant, and Consultant hereby agrees to perform all of the services set forth in the Authority's Request for Proposals for Aspinwall Pump Station to Lanpher Reservoir Rising Main PWSA Project No. 2018-323-100-0 as well as Addenda 1 and 2 (the "Request for Proposals") and Consultant's September 18, 2018 Technical Proposal for the Aspinwall Pump Station to Lanpher Reservoir Rising Main PWSA Project No. 2018-323-100-0 (the "Technical Proposal") and the October 31, 2018 letter from Consultant (collectively, the "Services"), a copy of each is attached hereto and incorporated herein as Exhibits A and B, respectively. The Authority's Request for Proposals and Consultant's Technical Proposal describe in greater detail the Services and the method by which the Services shall be performed. Where a conflict exists between the Authority's Request for Proposals and Consultant's Technical Proposal, the more stringent obligations for Services shall apply.

2.2 Consultant is required to assign the Project Manager and other key personnel named in Consultant's Technical Proposal. Replacement of such key personnel must be with an individual of similar background and experience and must be approved by the Authority. It is

expected that the key personnel remain the same throughout the term of this Agreement unless a change is necessitated due to constraints outside the Consultant's control including but not limited to voluntary separation of employment by key personnel or death.

2.3 The Authority and Consultant are mutual obligated to keep open and regular channels of communication in order to ensure the successful execution of this Agreement. Consultant shall provide a written record, and provide such written record to the Authority, of any meeting(s) with the Authority. Both parties are responsible for communicating any potential problems, issues and risks to the Authority's Project Manager and Consultant's Project Manager, respectively, within two (2) business days of becoming aware of the problem.

3. Compensation.

3.1 As full and complete compensation for the performance of the Services, the Authority shall pay Consultant and Consultant shall accept a fee (including all fees, costs and expenses) of Four Million Six Hundred Fifty-Eight Thousand Ninety Dollars and No Cents ($4,658,090.00) (hereinafter, the "Fee").

3.2 Consultant shall submit to the Authority via eBuilder, on a monthly basis on later than the 15th of the month for Services completed in the preceding month, properly detailed invoice(s) setting forth the Services performed and any expenses incurred. Consultant's billed hourly rates shall be based upon the agreed upon hourly rates, if applicable, and for the Services actually performed and expenses actually incurred during the monthly billing cycle. For any agreed upon subcontracted Services, Consultant shall bill for the portion of the subcontractor's Services performed during the monthly cycle. Consultant shall provide such supporting documentation or data as the Authority may reasonably require. The Authority shall provide payment to Consultant within forty-five (45) days of receipt and approval of the Services performed and each invoice.

3.3 Consultant agrees that, unless authorized by the Authority in writing, Consultant shall not be reimbursed for travel time.

3.4 The Authority will reimburse for the following, documented expense charges as part of this Agreement: (a) photocopying and printing at a cost up to a maximum of two dollars per page or print; (b) reasonable postage; (c) reasonable travel expense, including airline transportation not to exceed coach fares; (d) mileage for roundtrips greater than 100 miles roundtrip; (e) parking expense; and (f) messenger delivery and air freight/courier expense. For all such charges set forth in this Paragraph, Consultant shall provide documentation of the actual expense incurred as part of the invoice(s) submitted to the Authority. In the event that Consultant does not submit such documentation, the Authority reserves the right to reject the charges set forth in the invoice(s).

4. Additional Services. If Consultant and/or the Authority perceives the need for or anticipates a change in the scope of Services, the requesting Party shall notify the other Party. If the Authority agrees to change the scope of the Services performed under this Agreement, the Authority shall issue a written request for such change in the scope of Services. Consultant agrees that any such additional services shall be subject to the standard hourly rates agreed upon by the Authority and Consultant. Consultant shall provide the Authority with a written estimate of the time and costs for such change in the scope of Services. If the Parties agree upon the performance of such change

in the scope of Services, the Parties shall enter into a written and signed change order. Any claim for compensation for additional services must be agreed upon, in writing, by the Authority. In no event shall the Authority be liable for any claim for additional services that are not agreed upon, in writing, by the Authority.

5. Term. The term of this Agreement shall commence upon the Authority's issuance of a Notice to Proceed. Time is of the essence of this Agreement. Consultant shall make commercially reasonable efforts consistent with the Standard of Care to complete the Services contemplated herein on or before March 31, 2024 (the "Term"). Thereafter, this Agreement shall not renew, unless agreed upon in writing between the Parties.

6. Relationship of the Parties. Consultant will act as an independent contractor, and is retained by the Authority only for the purposes and to the extent set forth in this Agreement. Consultant, its employees, agents, subcontractors and permitted assignees, are not to be considered the agents or employees of the Authority for any purpose.

7. Consultant's Standard of Care.

7.1 The "Standard of Care" applicable to Consultant's services is the degree of skill and diligence normally employed by providers of engineering and technical services performing the same or similar services. Consultant shall employ employees and subcontractors, if applicable, with sufficient skill and experience to perform the Services. Consultant makes no warranties, express or implied, under this Agreement or otherwise, in connection with the services performed by the Consultant. Consultant agrees that, if the Authority determines that any employee and/or subcontractor is uncooperative, incompetent, a threat to the adequate or timely completion of the Services, a threat to the safety of persons or property or fails or refuses to perform the Services in accordance with the Standard of Care, Consultant shall promptly remove such employee and/or subcontractor from the performance of Services and such employee and/or subcontractor shall not perform any further Services under this Agreement.

7.2 Consultant shall fully obey and comply with all laws, ordinances, resolutions and administrative regulations applicable to any Services provided under this Agreement.

7.3 For any Services performed on the Authority's premises, Consultant agrees, while working on the Authority's premises, to observe the Authority's rules and policies relating to the security thereof, access to or use of all or part of the Authority's premises and any of the Authority's property, including proprietary or confidential information. Consultant agrees that when it is working on the Authority's premises, its personnel shall observe the Authority's administrative and ethics codes relating to the security, access or use of all or part of the Authority's premises and any of the Authority's property, including proprietary or confidential information. The Authority shall provide Consultant with any such written, applicable ethics codes.

7.4 Consultant agrees to work closely with the Authority's staff in the performance of Services and shall be available to the Authority's staff, consultants, and other staff at all reasonable times as it relates to direct performance of Services under this Agreement.

7.5 All Services provided under this Agreement shall be subject to reasonable monitoring and evaluation by the Authority or its authorized representatives. Consultant shall prepare, and submit to the Authority, a schedule identifying all tasks required for the performance of the Services and clearly indicate the critical path activities in such schedule. Consultant shall update such schedule on a monthly basis, and compare the status of each task with the original schedule submitted to the Authority. Consultant shall also provide the Authority with such additional information and data as may be reasonably and periodically required by federal or state authorities, or by the Authority itself. Authorized representatives of the Authority shall have access to the books and records maintained by Consultant with respect to any services or materials provided to the Authority pursuant to this Agreement at all reasonable times and for all reasonable purposes, including, but not limited to, inspecting and copying any books, records, memoranda, checks, correspondence or other relevant documents. All such books and records shall be preserved by Consultant for a period of three (3) years after the termination of this Agreement.

7.6 The Authority shall not be responsible for discovering deficiencies in the technical accuracy of Consultant's Services. If any of the Services provided by Consultant contains an error or omission which was within Consultant's control and was not attributable to any act or omission of the Authority, Consultant shall, at its own cost and expense, furnish all services as shall be necessary to correct or revise any such error or omission during the course of performance of this Agreement and for a period of twelve (12) months following its expiration or other termination. In the event Consultant fails or refuses to perform those services necessary to correct or revise its error or omission, the Authority shall have the right to undertake such corrective services itself or to retain third parties to undertake them. In such event, Consultant shall be obligated to reimburse the Authority for the reasonable and actual costs incurred in connection with the corrective services, plus administrative costs equal to five percent (5%) of the actual costs, within thirty (30) days of being invoiced therefor.

7.7 The obligations set forth in this Section 7 shall be in addition to and shall not limit in any way any other applicable rights or remedies available to the Authority at law or in equity under applicable law or this Agreement.

7.8 Consultant shall promptly pay its subconsultants and any other persons it engages to perform the Services in accordance with the terms of its negotiated agreement(s) with such parties. Should Consultant fail to do so, the Authority may retain out of any payment due Consultant an amount sufficient to discharge the same. Any failure of the parties to agree on the amount(s) withheld or the reason(s) for withholding shall be considered a dispute under this Agreement.

8. Authority's Responsibilities.

8.1 The Authority will designate a "Project Manager" who will have primary responsibility for coordinating with Consultant the delivery of the Services. The Project Manager and the Authority will assure appropriate staffing and/or attendance, by Authority employees or agents, of Authority functions supporting the Services. The Project Manager will ensure that all Authority decisions are made in a timely manner.

8.2 The Authority will furnish other information, documents or other records within its control and relevant to the Services within a reasonable time of receiving Consultant's request therefor, including but not limited to: (a) available historic water and sewer record drawings; (b) GIS layers for water mains, valves, hydrants, combined sewers, storm sewers, manholes, inlets and catch basins; (c) Authority water, sewer and GI master bid item excel documents containing standard unit bid items, measurements and item descriptions; (d) Authority guideline specification sections; (e) Authority standard CAD drawing border; (f) Authority standard community meeting PowerPoint template; (g) previous reports and studies compiled; and (h) previous closed-circuit television inspection reports and dye test results.

9. Insurance.

9.1 Prior to the beginning of any Services under this Agreement, Consultant shall deliver to the Authority certificates of insurance evidencing the following minimum coverages:

9.1.1 Workers compensation insurance at statutory limits and employer's liability insurance with limits of one million ($1,000,000.00) dollars. Consultant will have attached to its policy an alternate employer endorsement naming the Authority and will provide a waiver of subrogation in favor of the Authority.

9.1.2 Commercial general liability insurance with limits of two million ($2,000,000.00) dollars each claim and four million ($4,000,000.00) dollars in the aggregate and containing or endorsed to contain the following coverages: contractual liability; broad form property damage; personal/advertising injury; an endorsement including the Authority as an additional insured; waiver of subrogation to the benefit of all additional insureds; no explosion, collapse or underground exclusion; and, for any claims related to the Services, provision that Consultant's insurance shall be primary and non-contributory and any insurance or self-insurance maintained by the Authority shall be excess of Consultant's insurance and not contribute with it.

9.1.3 Automobile liability insurance with limits of one million ($1,000,000.00) dollars per claim and in the aggregate for bodily injury and property damage. Such automobile liability insurance shall cover all owned automobiles as well as non-owned automobiles operated by Consultant. The policy shall be endorsed to include the Authority as an additional insured and to include waiver of subrogation to the benefit of additional insureds.

9.1.4 Professional liability insurance with limits of five million ($5,000,000.00) dollars per claim and annual aggregate. The policy shall be endorsed to include a waiver of subrogation to the benefit of the Authority. If coverage is on a claims-made form, Consultant shall maintain continuous coverage or shall exercise an extended discovery period for at least two (2) years following the expiration or other termination of this Agreement.

9.1.5 Excess or umbrella liability insurance with limits of five million dollars ($5,000,000.00).

9.2 Except where stated otherwise in Subsection 9.1 above, the policies or coverages required by this Section shall be maintained during the term of this Agreement.

9.3 All insurance coverages must be placed with insurance carriers having an AM Best rating of A- or higher rating.

9.4 Each policy required by this Section 9 shall be endorsed to state that coverage shall not be suspended, voided, cancelled, reduced, or limits or certificate holder be deleted as an additional insured except after thirty (30) days' prior written notice, by certified mail, return-receipt requested, has been given to the Authority.

9.5 Unless approved in writing by the Authority, all deductibles and self-insured retentions under policies required by this Section 9 shall be the responsibility of Consultant.

9.6 The failure of the Authority to pursue or obtain any certificate of insurance or endorsement or to point out any non-compliance of any certificate of insurance or endorsement shall not constitute a waiver of any of the insurance requirements of this Agreement or relieve Consultant of any of its obligations hereunder.

9.7 Self-funded or other non-risk transfer insurance mechanisms are not acceptable to the Authority. If Consultant has such a program, full disclosure must be made to the Authority prior to any consideration being given. Consultant discloses that, as part of its insurance, Consultant's Professional Liability Program includes a lead-in deductible of $200,000.00 (per claim) and a Self-Insured Retention (SIR) of $2,500,000.00. The Authority agrees to the Professional Liability Program disclosure provided herein.

9.8 These insurance provisions are intended to be a separate and distinct obligation on the part of Consultant. The Authority's acceptance of insurance submitted by Consultant does not relieve or decrease in any way the liability of Consultant for performance under this Agreement.

10. Indemnity.

10.1 To the fullest extent permitted by law, Consultant shall indemnify, defend and hold harmless the Authority, its officers, agents and employees, from and against liens, charges, claims, penalties, damages, demands, judgments, liabilities, losses, and expenses for bodily injury, death or physical injury to tangible property, caused or allegedly caused by or arising from the performance of Consultant under this Agreement, but only to the extent caused or allegedly caused or caused in part by the negligent acts or omissions of Consultant, its employees, agents or persons for whose acts Consultant may be liable.

10.2 To the fullest extent permitted by law, Consultant shall indemnify and hold harmless the Authority, its officers, agents and employees, from and against claims and damages arising out of or resulting from the performance of the professional services of Consultant under this Agreement, but only to the extent caused in whole or in part by the negligent acts or omissions of Consultant, its employees, agents or persons for whose acts Consultant may be liable.

10.3 To the fullest extent permitted by law, Consultant shall indemnify, defend and hold harmless the Authority, its officers, agents and employees from liens, charges, costs, claims, demands, losses, judgments, liabilities and damages of every kind and nature, including, but not limited to, court costs and reasonable attorney's fees arising from or based upon any violation by Consultant of any laws, regulations, ordinances or codes.

10.4 Consultant shall defend, indemnify and hold harmless the Authority, together with its managers, officers, agents, employees and affiliates, from and against loss, liability, claim, damage, expense (including reasonable costs of investigation, defense and attorneys' fees) third party claims, arising, directly or indirectly, from or in connection with Consultant's infringement on any intellectual property rights of any third party.

10.5 Unless specifically provided in this Agreement, the defense and indemnification obligations accepted by Consultant under this Section 10 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by Consultant, or by Consultant's subcontractors or permitted assigns, pursuant to any applicable workers' compensation statute or disability benefit statute or any other employee benefit law, rule or regulation.

11. Rights in Data; Copyrights; Disclosure.

11.1 Definition. The term "Data" as used in this Agreement includes written reports, studies, drawings, or other graphic, electronic, chemical or mechanical representations.

11.2 Subject to receipt of payment due and owing for Consultant's Services satisfactorily performed, all Data developed or created pursuant to this Agreement shall be the property of the Authority and the Authority shall have the full right to use such Data for any official purpose and in whatever manner deemed desirable and appropriate, including making it available to the general public. Such use shall be without any additional payment to or approval by Consultant. The Authority shall have unrestricted authority to publish, disclose, distribute and otherwise use, in whole or in part, any Data developed or prepared under this Agreement. However, any reuse of such Data by the Authority on any other project shall be at the sole risk of the Authority. Notwithstanding the foregoing, Consultant, shall retain its rights in its GIS Software used for the automation of quality control and quality assurance process and all rights to any other pre-existing intellectual property utilized, or modified in the performance of the Agreement that existed prior to the execution of this Agreement

11.3 Consultant hereby relinquishes, or shall cause to be relinquished, any and all copyrights and/or privileges to Data developed or prepared under this Agreement without any additional payment to Consultant therefor. However, Consultant may use copies of Consultant's work products prepared pursuant to this Agreement as part of its record of professional activity. Consultant shall not include in the Data any copyrighted matter unless Consultant obtains the written approval of the Project Manager of the Authority and provides said Project Manager with written permission of the copyright owner for Consultant to use such copyrighted matter in the manner provided herein.

11.4 Unless expressly permitted in writing, no Data developed or prepared, in whole or in part, under this Agreement shall be subject to a third party's copyright in the United States of America or in any other country. Further, unless expressly permitted in writing, Consultant, in rendering the Services, represents and warrants that it shall not infringe any intellectual property, brand identity, invention, discovery, development, improvement, innovation or trade secret rights of any third party.

12. Compliance with Laws. Consultant shall fully obey and comply with all laws, ordinances and administrative regulations made in accordance therewith, which are applicable to the Services performed under the terms of this Agreement.

13. Anti-Discrimination. Consultant shall not discriminate in its employment on the basis of race, color, religion, ancestry, national origin, place of birth, sex, age, disability, non-job related handicap or sexual orientation. Consultant shall comply with the applicable provisions of the Pittsburgh Code, Title Six - Conduct, Article V - Discrimination, and any amendments thereto. Consultant shall also comply with the applicable provisions of Title I and Title II of the Americans with Disabilities Act, any amendments thereto and any regulations issued thereunder. Consultant shall incorporate in any subcontracts which may be permitted under the terms of this Agreement a requirement that said subcontractors also comply with the provisions of this Section.

14. Minority, Women, Veteran and Service Disabled-Veteran Business Enterprise Participation. The Authority's current goal for Minority Business Enterprise ("MBE") participation is eighteen percent (18%), for Women Business Enterprise ("WBE") participation is seven percent (7%) and for Veteran Business Enterprise ("VBE")/Service Disabled-Veteran Business Enterprises ("SDVBE") participation is five percent (5%) of the total dollar value of the Authority's contracts. The Authority's duty and obligation to make final payment under this Agreement is conditioned upon the Authority's receipt of a report from Consultant detailing (i) the total dollar amount of the Agreement that went to WBEs, along with the names and addresses of the WBEs (if any), (ii) the total dollar amount of the Agreement that went to MBEs, along with the names and addresses of the MBEs (if any), (iii) the total dollar amount of the Agreement that went to VBEs/SDVBEs, along with the names and addresses of the VBEs/SDVBEs (if any), and (iv) an explanation of any failure to meet the MBE, WBE and VBE/SDVBE goals set forth herein. This Section does not convey a requirement to meet MBE, WBE and VBE/SDVBE goals and final payment to Consultant shall not be withheld if the Authority's goal is not achieved, unless Consultant fails to provide an explanation as to why the MBE, WBE and VBE/SDVBE goals were not met.

15. Subcontracting and Assignment.

15.1 None of the Services covered by this Agreement shall be subcontracted or assigned without the prior written approval of the Authority, which shall not be unreasonably conditioned, delayed or withheld. Such approval or consent will not relieve Consultant of its obligations under this Agreement and Consultant shall remain responsible for any assigned and/or subcontracted obligations under this Agreement. Any subcontractors that were included as part of Consultant's proposal are hereby considered approved.

15.2 The Authority reserves the right to object and require the replacement of any subconsultant who is hired or retained without the Authority's prior written consent.

15.3 For any subcontracted Services agreed upon by the Authority in writing, such subcontractor shall be entirely and exclusively under the direction, supervision and control of Consultant.

16. Force Majeure. No delay or failure of performance by either party shall constitute default hereunder or give rise to any claims for damage if, and to the extent, such delay or failure is caused by (including but not limited to) fire or other casualty, labor dispute or transportation delay not caused in any way by the affected party, or by government or military action, inclement weather not reasonably anticipatable, act of God, act or omission of the other party or its other contractors, failure of any government authority to timely review or to approve the services or to grant permits or approvals, or any other cause beyond the affected party's reasonable control.

17. **Events of Default.** Any of the following will constitute an Event of Default:

17.1 Consultant is adjudged bankrupt and it makes a general assignment for the benefit of creditors, or a receiver is appointed due to its insolvency;

17.2 Consultant persistently or repeatedly refuses or fails, except in situations where an extension of time is provided, to supply enough properly skilled professionals or other workers;

17.3 Consultant persistently disregards Applicable Laws or the requirements of any Standards or Permits;

17.4 Consultant unreasonably delays, except in situations where an extension of time is provided, the performance and/or completion of the Services contemplated in this Agreement; and/or

17.5 Consultant fails to comply with any material term of this Agreement, including, but not limited to the obligation to timely pay any subconsultants.

18. Termination for Cause.

18.1 Consultant shall have seven (7) days to cure an Event of Default. Should Consultant fail to remedy the Event of Default to the satisfaction of the Authority, the Authority shall have the right:

18.1.1 to remedy the deficiency and deduct the cost thereof from any payment then or thereafter due to Consultant;

18.1.2 to terminate the Agreement and to complete the Services by whatever method the Authority deems expedient; and/or

18.1.3 to pursue any other remedy available at law or equity

18.2 Upon receipt of a termination notice from the Authority, Consultant shall:

18.2.1 stop the performance of all Services, except as may be necessary to carry out the termination;

18.2.2 either terminate or assign to the Authority, as the Authority may direct, any subcontracts or other contracts or purchase orders entered into by Consultant in performing the Services under this Agreement;

18.2.3 deliver to the Authority all documents prepared as part of the Services; and

18.2.4 take such other action toward termination of the Services as the Authority may reasonably direct.

If the Authority should suspend the Services under this Agreement for greater than 60 days, the Consultant shall have the right to terminate this Agreement at its convenience pursuant to Section 18 of this Agreement following the 60th day of the suspension.

19. Termination for Convenience.

19.1 The Authority shall have the right to terminate this Agreement for its convenience upon ten (10) days written notice to Consultant whenever the Authority determines such termination to be in its own best interest. Upon its receipt of notice of a termination for convenience, Consultant shall cease operations as directed by the Authority and shall take all actions as directed by the Authority for the preservation or protection of any of the products of the Services.

19.2 Upon a termination for the Authority's convenience, the Authority shall pay Consultant for all Services satisfactorily completed through the date of termination, less the sums Consultant shall have already been paid on account of the Services performed. The Authority shall not pay Consultant, and Consultant shall not be entitled to payment, for any Services not performed or for any anticipated profit for such non-completed Services.

20. Notices. Unless otherwise notified in writing, each party shall send notices and other communications to the other party at the address shown below:

To the Authority:
The Pittsburgh Water and Sewer Authority
1200 Penn Avenue
Pittsburgh, PA 15222
Attention: Executive Director

To Consultant:
Michael Baker International, Inc.
100 Airside Drive
Moon Township, PA 15108
Attention: Brad Duda

21. *Disputes or Controversies*. *Should any dispute or controversy whatsoever arise* between Consultant and the Authority with respect to the Agreement or any Services performed by Consultant or its subconsultants or permitted assigns pursuant to the Agreement, then the

complaining party shall give the other party thirty (30) days' written notice of the complaining party's intent to resort to legal action. In the event that Consultant brings and/or files a lawsuit against the Authority, and does not prevail on more than 50% of the matters in its lawsuit against the Authority, Consultant shall compensate the Authority for any and all reasonable attorneys' fees and costs incurred by the Authority to defend itself against Consultant's lawsuit.

22. Confidentiality.

22.1 Consultant will not release any information related to the Services or publish any reports or documents related to the Services, nor publish any reports or documents related to the Agreement, without the prior written consent of the Authority, which may be withheld or conditioned as deemed appropriate by the Authority in its sole discretion.

22.2 Consultant agrees to hold all materials and information belonging to the Authority or the Authority's agents in confidence and not to make use thereof other than for the performance of its contractual obligations, to release it or to disclose it to any other entity and/or individual.

22.3 Consultant will not, either during or after performance of the Services, except as required in the performance of the Services or with the prior written consent of the Authority, communicate or divulge to, or use for the benefit of Consultant or any other person, firm, association, or corporation, any confidential or proprietary information of the Authority, including but not limited to the project deliverables and other data reviewed or developed during the performance of the Services.

22.4 Any information of a restricted nature provided to Consultant by the Authority in the course of implementation of this Agreement shall be handled in accordance with the restrictions placed thereon by the Authority. Information or documents given to or generated by Consultant in the course of the Agreement shall be considered restricted information and subject to handling and dissemination restrictions as specified herein and/or as specified by the Authority.

22.5 The preceding restrictions shall not apply to information that is required to be disclosed by operation of law or properly issued subpoena by a court of competent jurisdiction in the public domain, was previously known to Consultant, was acquired by Consultant from others who have no confidential relationship to Authority with respect to same, or which through no fault of Consultant, comes into the public domain

23. Collusion. Consultant certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing this Agreement. For purposes of this Agreement, the following definitions shall apply:

23.1 "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official or Authority employee in the bidding/proposal process or in the Agreement execution;

23.2 "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding/proposal process or the execution of the Agreement to the detriment

of the Authority, (b) to establish the Agreement prices at artificial non-competitive levels, or (c) to deprive the Authority of the benefits of free and open competition;

23.3 "collusive practice" means a scheme or arrangement between two or more companies, with or without the knowledge of the Authority, a purpose of which is to establish Agreement prices at artificial, non-competitive levels; and

23.4 "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding/proposal process or affect the execution of the Agreement.

24. Taxes. Consultant shall be solely responsible to pay all applicable federal, state and local taxes and to file all related returns and reports in connection with the performance of Services. Consultant acknowledges that the Authority has no obligation to and shall not withhold taxes of any kind or nature with respect to the Services performed by Consultant. Consultant shall defend, indemnify and hold the Authority harmless to the extent of any obligation of Consultant to pay any taxes, whether income or otherwise, in connection with any payments made to Consultant by the Authority.

25. Conflict of Interest. Consultant covenants and represents that neither it, nor any officer or principal of its firm, has, or shall acquire any investment, income, business entity, interest in real property, or other interest, directly or indirectly, which would conflict in any manner with the interests of Authority, hinder Consultant's performance of Services under this Agreement, or be affected in any manner or degree by performance of the Services hereunder. Consultant further covenants that in the performance of the Agreement, no person having any such interest shall be employed by it as an officer, employee, agent, or subcontractor without the express written consent of Authority. Consultant agrees to at all times avoid conflicts of interest, or the appearance of any conflicts of interest, with the interests of Authority in the performance of the Agreement.

26. Binding Agreement; Successors. This Agreement will be binding upon, inure to the benefit of and be enforceable by, the successors and approved assigns of the parties hereto.

27. Governing Law, Disputes and Controversies.

27.1 This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania without regard to any applicable principles of conflicts of laws.

27.2 Should any dispute or controversy whatsoever arise between Consultant and the Authority with respect to the Agreement or any Services performed by Consultant or its subconsultants or permitted assigns pursuant to the Agreement, then the complaining Party shall give the other party thirty (30) days' written notice of the complaining Party's intent to resort to legal action.

27.3 The Authority and Consultant agree that they may first submit any unsettled claims, counterclaims, disputes, and other matters in question between them arising out of or

relating to this Agreement or the breach thereof ("Disputes") to mediation by the American Arbitration Association or private mediator, which venue shall be selected at the sole option of the Authority. The Parties agree to participate in the mediation process in good faith. The process shall be conducted on a confidential basis, and shall be completed within 120 days of either the Authority or Consultant raising a Dispute.

27.4 The Parties agree that any Dispute shall be resolved, at the Authority's sole option, through arbitration or through litigation in the Court of Common Pleas of Allegheny County, Pennsylvania.

27.5 If the Parties are unable to amicably resolve any Dispute through informal negotiations or mediation pursuant to Section 27.3 of this Agreement and in the event that the Authority elects to resolve any Dispute through arbitration, the arbitration shall be held in accordance with the American Arbitration Association Construction Rules effective at the Effective Date of the Agreement, subject to the following conditions: (1) Notice of the demand for arbitration must be filed in writing with the other party to the Agreement and with the American Arbitration Association or with a private arbitration, which venue shall be determined at the sole election of the Authority. The demand must be made within a reasonable time after the Dispute has arisen. In no event may the demand for arbitration be made after the date when institution of legal or equitable proceedings based on such Dispute would be barred by the applicable statute of limitations; (2) All demands for arbitration and all answering statements thereto which include any monetary claims must contain a statement of the total sum or value in controversy as alleged by the party making such demand or answering statement; (3) The rules of any arbitration shall be supplemented to include the following: The award rendered by the arbitrator(s) shall be in writing, and shall include (a) a precise breakdown of the award; and (b) if requested by the Authority, a written explanation of the award specifically citing the Agreement provisions deemed applicable and relied on in making the award; (4) The award rendered by the arbitrators will be consistent with the terms of this Agreement and final, and judgment may be entered upon it in any court having jurisdiction thereof, and will not be subject to appeal or modification; and (5) If a Dispute in question between the Parties involves the work of a Contractor, Subcontractor, or consultants to the either of the Parties (each a "Joinable Party"), and such Joinable Party has agreed contractually or otherwise to participate in a consolidated arbitration concerning the Specific Project, then either the Authority or Consultant may join such Joinable Party as a party to the arbitration between the Parties hereunder. Nothing in this Paragraph or in the provision of such contract consenting to joinder shall create any claim, right, or cause of action in favor of the Joinable Party and against the Authority or Consultant that does not otherwise exist.

28. Waiver of Consequential Damages. In no event shall either Consultant or the Authority have any claim or right against the other, whether in contract, warranty, tort (including negligence), strict liability or otherwise, for any special, indirect, incidental, or consequential damages or any kind or nature whatsoever, such as but not limited to loss of revenue, loss of profits on revenue, loss of customers or contracts, loss of use of equipment or loss of data, work interruption, increased cost of work or cost of any financing, howsoever caused, even if same were reasonably foreseeable.

29. Waiver. The failure of either Party to require the performance of any term or obligation of this Agreement, or the waiver by either Party of any breach of this Agreement, shall not prevent any subsequent enforcement of such term or obligation or be deemed a waiver of any subsequent breach.

30. Severability. If any provision of this Agreement shall be held to be invalid or unenforceable for any reason, the remaining provisions shall continue to be valid and enforceable.

31. Entire Agreement; Amendment. This Agreement constitutes the entire agreement between the Parties with respect to its subject matter and supersedes all other agreements, whether oral or written, between the Parties with respect to such subject matter. In the event of a conflict between the terms of this Agreement and Exhibits A and B, the terms of this shall govern. This Agreement may be amended only by a written agreement executed by each of the Parties hereto.

32. Audit. At any time up to three years after the day of final payment, Consultant will provide the Authority with access to its records related, in any way, to the Program and/or this Agreement for inspection and audit.

33. Counterparts; Facsimile. This Agreement may be executed in one or more counterparts, each of which shall be deemed to be an original, but all of which together shall constitute one and the same instrument. This Agreement may be executed and delivered by facsimile or electronic transmission, and a facsimile or electronic version of this Agreement or of a signature of a Party will be effective as an original.

34. Miscellaneous.

34.1 Section headings in this Agreement are for convenience of reference only and shall not constitute a part of this Agreement for any purpose.

34.2 Notwithstanding the expiration or termination of this Agreement, the rights and obligations set forth in sections 7, 9, 10, 11, 12, 20, 21, 22, 23, 23, 25 and 27 shall continue in full force and effect.

34.3 This Agreement is entered into by the Authority pursuant to Agenda Item No. 149 of 2018, approved at a meeting of its Board held on November 16, 2018.

[signatures follow on next page]

IN WITNESS WHEREOF, the parties have duly executed this Agreement, with respect to the performance of professional engineering design and construction engineering phase services to assist the Authority as part of the construction of a rising main from the Aspinwall Pump Station to Lanpher Reservoir, as detailed herein, the day and year first above written.

WITNESS:

THE PITTSBURGH WATER AND SEWER AUTHORITY

By: _____
Name: ROBERT A. WEIMAR
Title: EXECUTIVE DIRECTOR

Approved as to form:

Authority ~~Solicitor~~ Legal Counsel

WITNESS:

MICHAEL BAKER INTERNATIONAL, INC.

By: _____
Name: William S. Almes
Title: Vice President

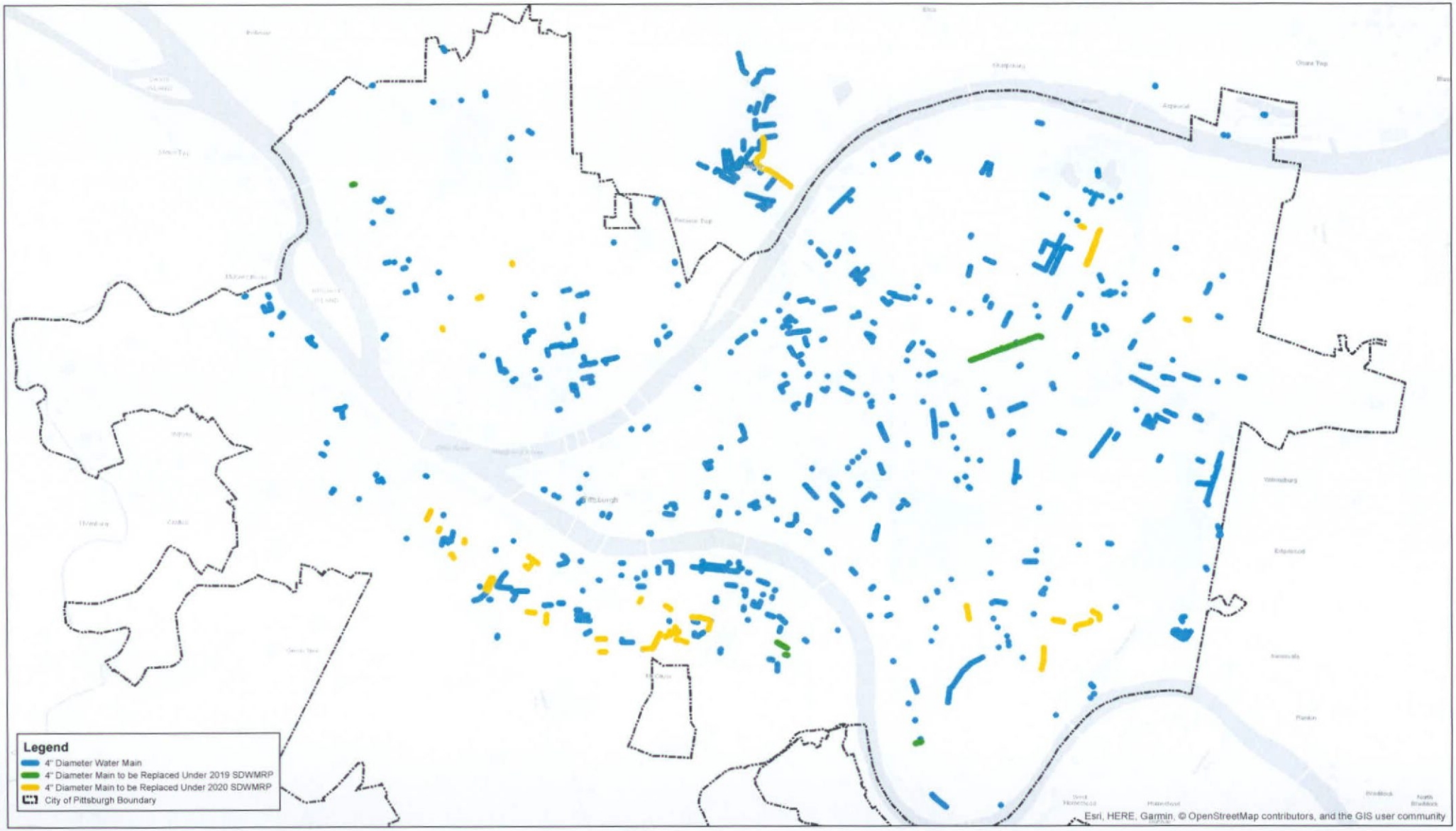
EXHIBIT "A"

Authority's Request for Proposals for the Aspinwall Pump Station to Lanpher Reservoir Rising Main PWSA Project No. 2018-323-100-0 as well as Addenda 1 and 2

EXHIBIT "B"

Consultant's September 18, 2018 Technical Proposal for the Aspinwall Pump Station to Lanpher Reservoir Rising Main PWSA Project No. 2018-323-100-0 and Consultant's October 31, 2018 Letter

Exh. RAW/C-20



PGH2O
Pittsburgh
Water & Sewer
Authority
Drawn by: EJK Date: 2/12/2019

Neither the City of Pittsburgh nor the PWSA guarantees the accuracy of any of the information thereby made available, including but not limited to information concerning the location and condition of underground structures, and neither assumes any responsibility for any conclusions or interpretations made on the basis of such information. COP and PWSA assume no responsibility for any understanding or representations made by their agents or employees unless such understanding or representations are expressly set forth in a duly authorized written document, and such document expressly provides that responsibility therefore is assumed by the City or the PWSA.

4 Inch Diameter Water Main Overview

pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

April 27, 2018

CERTIFIED MAIL NO. 7016 2070 0000 5050 7118

Robert A. Weimar, Executive Director
Pittsburgh Water & Sewer Authority
Penn Liberty Plaza I
1200 Penn Avenue
Pittsburgh, PA 15222

Re: **Corrosion Control Treatment Feasibility Study**
Pittsburgh Water and Sewer Authority
Public Water Supply ID No. 5020038
Allegheny County

Dear Mr. Weimar:

We have completed our review of the Pittsburgh Water & Sewer Authority's (PWSA) Corrosion Control Feasibility Study (Feasibility Study) as submitted by Mott MacDonald under cover dated March 29, 2018. The Department hereby approves your selection of orthophosphate as optimal corrosion control treatment for PWSA's system.

Under Paragraph 3.6.ii of the November 17, 2017 Consent Order & Agreement, PWSA is required to submit an application for a permit to construction the optimal corrosion control for facilities within ninety (90) days of the date of this approval. The corrosion control treatment application should address the following:

1. Provide initial and maintenance dosages as well as target pH range at the entry point and at the water quality parameter sampling locations within the distribution system.

2. All six PRS distribution system monitoring stations (2 existing stations and 4 that were used for the Feasibility Study) should be used at points throughout the distribution system to derive the optimal orthophosphate maintenance dose.

3. Design shall ensure orthophosphate does not enter the Highland 1 Reservoir.

4. Design shall ensure all customers receive optimal corrosion control treatment.

5. Provide an orthophosphate distribution system sampling plan (as per Section 8.3 of the Feasibility Study).

6. Provide uni-directional flushing plan (as per Section 8.4 of the Feasibility Study), including locations and timeline.

7. Provide a plan to ensure biological stability in the distribution system (as per Section 8.6.1 of the Feasibility Study).

8. Provide results from scale analyses of the pipe segments used in the pipe loops and plates and similar homes with lead service lines prior to addition of the optimal corrosion control treatment (as per Section 8.6.4 of the Feasibility Study).

9. PWSA shall identify any and all chemicals to be used for pH adjustment, for both pre- and post-filtration and amend permits accordingly.

10. The chloride-to-sulfate mass ratio (CSMR) can influence the rate of galvanic lead corrosion. PWSA should evaluate options to reduce the CSMR below 0.6 as recommended by EPA.

If you have any questions, please contact Cliff Dashti at 412-442-4118.

Sincerely,

Alan Eichler
Program Manager
Safe Drinking Water Program

Enclosures

cc: Region File

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SEP 24 2018

CERTIFIED MAIL NO. 7003 2260 0005 8734 2739

Robert A. Weimar, Executive Director
Pittsburgh Water and Sewer Authority
Penn Liberty Plaza I
1200 Penn Avenue
Pittsburgh, PA 15222

Re: Public Water Supply
Construction Permit No. 0218518
Pittsburgh Water and Sewer Authority
PWS ID No. 5020038
City of Pittsburgh
Allegheny County

Dear Mr. Weimar:

We are pleased to enclose Public Water Supply Permit No. 0218518 for the installation of corrosion control systems at Aspinwall Pump Station (3 application points), Bruecken Pump Station (2 application points) and Highland Reservoir 1 Microfiltration plant (2 application points). This permit is issued in response to your application received on May 10, 2018 with revisions through August 22, 2018.

As discussed during a conference call between the Department and PWSA on September 20, 2018, the three application points at the Aspinwall pump station, the two application points at the Bruecken pump station and the two application points at the Highland Reservoir 1 MHP must become operational simultaneously unless a certification signed and sealed by a Professional Engineer registered in Pennsylvania which documents there will be no adverse health effects and no connectivity or crossflow between portions of the distribution system that will be being fed with phosphoric acid and the portions of the distribution that will not have phosphoric acid fed.

Please note the Special Conditions attached to your permit.

Issuance of the enclosed construction permit is authorized in accordance with the provisions of the laws of the Commonwealth. **Operation of the above-mentioned facilities is <u>not</u> authorized. Our office should be notified at least 30 days prior to your plan to use the proposed facility so that an inspection can take place.** If the facility has been constructed in accordance with the construction permit, an operation permit will then be issued.

This construction permit will expire 2 years from the date of issuance unless substantial work is initiated. The Department may grant extensions if a written request is submitted prior to the expiration date.

Please have your authorized representative and supervising engineer complete the enclosed Certificate of Construction/Modification Form and mail it to our office when construction is complete. **Emails or facsimiles will not be accepted. All analyses as may be required by your permit special conditions will need to be attached to the Certificate of Construction in order for it to be considered a complete application.** Also note that your Certified Operator's certificate number will be needed in completing this form. **Upon receipt of a complete application, we will schedule an inspection so an operations permit can be issued.**

This authorization does not relieve the applicant from applying for and obtaining any additional permits or approvals from local, state or federal agencies required for this project. Please be advised that if any other permits are required for this project, they must be issued prior to undertaking the activities described in the permit application. Issuance of the enclosed permit(s) does not indicate an affirmative action on any other pending or future permit applications. If you are uncertain as to whether or not other permits are needed for this project, please use the Department's "Permit Application Consultation Tool" (PACT) which can be found at http://www.ahs.dep.pa.gov/PACT/ . The online tool is designed to quickly and easily assist potential applicants in determining which types of environmental permits, authorizations or notifications would be needed for specific projects. Based on the user's responses to a series of simple questions, PACT automatically provides an email response with information on permits and other information an applicant should consider.

Any person aggrieved by this action may appeal the action to the Environmental Hearing Board (Board) pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. § 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A. The Board's address is:

Environmental Hearing Board
Rachel Carson State Office Building, Second Floor
400 Market Street
P.O. Box 8457
Harrisburg, PA 17105-8457

TDD users may contact the Environmental Hearing Board through the Pennsylvania Relay Service, 800-654-5984.

Appeals must be filed with the Board within 30 days of receipt of notice of this action unless the appropriate statute provides a different time. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

A Notice of Appeal form and the Board's rules of practice and procedure may be obtained online at http://ehb.courtapps.com or by contacting the Secretary to the Board at 717-787-3483. The Notice of Appeal form and the Board's rules are also available in braille and on audiotape from the Secretary to the Board.

IMPORTANT LEGAL RIGHTS ARE AT STAKE. YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD AT 717-787-3483 FOR MORE INFORMATION. YOU DO NOT NEED A LAWYER TO FILE A NOTICE OF APPEAL WITH THE BOARD.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST BE FILED WITH AND RECEIVED BY THE BOARD WITHIN 30 DAYS OF RECEIPT OF NOTICE OF THIS ACTION.

If you have any questions concerning this matter, please contact Cliff Dashti at 412.442.4118.

Sincerely,

Program Manager
Safe Drinking Water Program

Enclosures

cc: Southwest Regional Office
Region

3900-PM-BSDW0043 Rev. 7/2014

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF SAFE DRINKING WATER

Exh. RAW/C-22

PUBLIC WATER SUPPLY PERMIT

NO. 0218505MA

A. PERMITTEE: (Name and Address)	B. PROJECT/PLANT LOCATION
Pittsburgh Water & Sewer Authority Penn Liberty Plaza I 1200 Penn Avenue Pittsburgh, PA 15222	Address Aspinwall and Bruecken Pump stations and MFP sites 1&2 Municipality City of Pittsburgh County Allegheny

C. THIS PERMIT APPROVES FOR: 1. ☒ CONSTRUCTION 2. ☐ OPERATION OF FACILITIES
AS INDICATED BELOW: Approved Under Construction Permit No. _____

Source	Facilities		BVRB
☐ Well(s)	☐ Impoundment	☐ General Corrosion Control	☐ Bottled Water System
☐ Spring(s)	☐ Settling	☒ Corrosion Control for lead/copper	☐ Bulk Water Hauling System
☐ Surface Water	☐ Filtration	☐ Disinfection	☐ Vended Water System
☐ Finished Water	☐ Iron and Manganese Treatment	☐ Pump Station(s)	☐ Retail Water Facility
	☐ Softening	☐ Transmission Lines	
	☐ Fluoridation	☐ Finished Water Storage	
	☐ Distribution Facility	☐ Other _____	

KNOWN AS Addition of phosphoric acid for corrosion control at Aspinwall Pump Station (3 application points), Bruecken Pump Station (2 application points) and MFP Site (2 application points).

LIMIT OF AUTHORIZATION

YOU ARE HEREBY AUTHORIZED TO CONSTRUCT OR OPERATE, AS INDICATED ABOVE, PROVIDED THAT FAILURE TO COMPLY WITH CHAPTER 109, OF THE RULES AND REGULATIONS OF THE DEPARTMENT OF ENVIRONMENTAL PROTECTION OR THE TERMS OR CONDITIONS OF THIS PERMIT SHALL VOID THE AUTHORITY GIVEN TO THE PERMITTEE BY THE ISSUANCE OF THE PERMIT.

THE PLANS, SPECIFICATIONS, REPORTS AND SUPPORTING DOCUMENTS SUBMITTED AS PART OF THE PERMIT APPLICATION BECOME PART OF THE PERMIT.

NO DEVIATIONS FROM APPROVED PLANS OR SPECIFICATIONS AFFECTING THE TREATMENT PROCESS OR QUALITY OF WATERS SHALL BE MADE WITHOUT WRITTEN APPROVAL FROM THE DEPARTMENT.

THIS PERMIT IS ISSUED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION UNDER THE AUTHORITY OF THE PENNSYLVANIA SAFE DRINKING WATER ACT, THE ACT OF MAY 1, 1984 (P.L. 206, NO. 43). OPERATION SHALL COMPLY WITH THE PROVISIONS OF CHAPTER 109 ADOPTED UNDER THE AUTHORITY IN SECTIONS 4 AND 6(e) OF THE PENNSYLVANIA SAFE DRINKING WATER ACT.

THIS PERMIT IS SUBJECT TO THE ATTACHED SPECIAL CONDITIONS A - D.

PERMIT ISSUED

Date 9/24/18

DEPARTMENT OF ENVIRONMENTAL PROTECTION

By _____

Signer's Name Ronald A. Schmartz

Title Program Manager -Safe Drinking Water Program

Southwest Regional Office

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF SAFE DRINKING WATER

PUBLIC WATER SUPPLY PERMIT NO. 0218518

SPECIAL CONDITION

PITTSBURGH WATER AND SEWER AUTHORITY

Installation of Corrosion Control Systems at the at Aspinwall Pump Station (3 application points), Bruecken Pump Station (2 application points) and Highland Reservoir 1 Microfiltration plant (2 application points).

City of Pittsburgh
Allegheny County

A. This permit authorizes construction and not operation of the facilities. In accordance with 25 PA Code, Section 109.501(c) and 109.504, the permittee shall not operate the facilities until the permittee has obtained a Public Water Supply Operation permit. Upon completion of construction the permittee is to submit the Certificate of Construction/Modification certifying that the work has been completed in accordance with the approved plans and specifications, and that adequate operation and maintenance information for the approved facilities is available on site for use by the public water system's personnel. Upon receipt of the Certificate, the Department will schedule a pre-operation inspection to verify the information provided. Upon successful inspection, the permittee will be issued an Operations Permit.

B. The permittee is authorized to injection phosphoric acid (75%) at the following locations:

1	Aspinwall Pump Station	Aspinwall Pump Nos. I and 4
2	Aspinwall Pump Station	Aspinwall Pump Nos. 2 and 3
3	Aspinwall Pump Station	Fox Chapel Pump No. 4
4	Bruecken Pump Station	Rising Main No. 3
5	Bruecken Pump Station	Rising Main No. 4
6	Highland Membrane Plant Site	30-inch transmission main
7	Highland Membrane Plant Site	66-inch transmission main

Note: The maximum injection rate shall be 3.5 mg/l as PO_4. The minimum injection rate shall be 0.5 mg/l as PO_4.

C. All equipment and chemicals to be used in this project shall conform to NSF/ANSI 60 and 61 Standards.

D. Flow meters must be calibrated and functional at all seven injection point locations and tied into the SCADA system with high/low alarms.

Exh. RAW/C-23

PENNVEST APPLICATION FORMS

DESCRIPTION		
Project Name:	Pittsburgh WSA - LSL Replacement	
Project ID:	**Type:**	**Status:**
02261111807-CW	Drinking Water	Data Collection
Sub Type:	**Stage:**	
System	Construction	
Filing Date:	**Population Served:**	
7/26/2018	7000	
Amount Requested:	**Total Cost:**	
$49,710,103.85	$49,710,103.85	
What is the estimated number of construction-related jobs created through this project?	60	
What is the number of these jobs that expect to employ Pennsylvania Residents?	60	

Service Area:

The PWSA water system serves customers in the City of Pittsburgh and Millvale. The proposed 2019 LSLR Program will cover various areas within the City based on where curb box inspections have been completed, where there are higher population densities of children under 6 years of age, where there are higher blood-lead levels and where there are greater densities of lead service lines in these neighborhoods.

Problems:

Samples for lead have exceeded the regulatory action level in PWSA's water system. Lead laterals and service lines are contributing to the problem and will need replaced.

Description:

The proposed work will include the replacement of 2,800 public lead service line connections, including an estimated 2,400 private lead service lines. About 7 miles of lead service line pipe will be replaced through this program.

Other(s) Funding Sources:

Source Type	Source Name	Source Amount

System:	
Does the Applicant own the System?	NO

If 'No' explain: The PWSA is a lessee under a long term capital lease. All obligations under the lease have been met other than tendering $1 in 2025.

Does the Applicant operate the System?	YES
Does the Applicant Maintain the System?	YES
Does the Applicant Construct the System?	YES
Does this project include costs associated with the purchase of system capacity from another entity?	NO
Does this project include costs associated with the construction of capacity in your system for use and/or purchase by other entity (ies)?	NO
Is, or does the Applicant intend to be, a party to any inter-municipal agreements which affect this project or your system?	NO
Has the Applicant issued debt or borrowed money, or does the Applicant intend to issue debt or borrow money, under a trust indenture?	YES

If yes, you will be required to upload copies of the original trust indenture and all supplemental trust indenture to the Support Documents section when you complete this portion of the application.

Do you charge residential or commercial user fees?	YES

NPDES Number:	**PWSID Number:**
	5080038

Do you have a current Bond Rating?	YES

Rating Agency	**Rating**
S & P Global	A/Stable
Moody's	A2/Negative

Contacts:

Pittsburgh Water and Sewer Authority		Applicant	
Address:		**Phone:**	412-255-2563
1200 Penn Avenue, 2nd Floor		**Fax:**	
		Email:	
Pittsburgh, PA 15222-4204			
SAP Vendor #:	**DUNS:**	**Federal ID/FIN:**	
149243001	177822780	251463997	
PWSA		Engineer	
Address:		**Phone:**	412-255-8935
Penn Libery Plaza 1		**Phone Ext.:**	
1200 Penn Avenue		**Fax:**	412-255-2475
Pittsburgh, PA 15222-			
Clark Hill PLC		Legal	
Address:		**Phone:**	
Oxford Centre		**Phone Ext.:**	
301 Grant Street, 14th Floor		**Fax:**	
Pittsburgh, PA 15219			
PWSA		Financial	
Address:		**Phone:**	412-255-8935
Penn Libery Plaza 1		**Phone Ext.:**	
1200 Penn Avenue		**Fax:**	412-255-2475
Pittsburgh, PA 15222-			
Duffy, Daniel		Applicant	
Address:		**Phone:**	9787608370
1200 Penn Ave		**Phone Ext.:**	
Pittsburgh, PA 15222		**Fax:**	
		Email:	dduffy@pgh2o.com
Duffy, Daniel		Engineer	
Address:		**Phone:**	978-760-8370
		Phone Ext.:	
,		**Fax:**	
		Email:	dtduffy@pgh2o.com

Nowak, Esq., Mark	Legal	
Address:	**Phone:**	412-394-2428
	Phone Ext.:	
,	**Fax:**	
	Email:	mnowak@clarkhill.com

Lestitian, Esq., Debbie	Financial	
Address:	**Phone:**	412-255-8800
	Phone Ext.:	8972
,	**Fax:**	
	Email:	dlestitian@pgh2o.com

PROJECT SITE(S)

PWSA LSLR Replacement Area	Primary Site	
Address:	**Latitude:**	40.4457317
PWSA	**Longitude:**	-79.9916909
1200 Penn Ave		
Pittsburgh, PA 15222		

Counties and Municipalities

Primary	**County**	**Municipality**
True	Allegheny	Pittsburgh City
System	**Project**	**Households served**
True	True	2400

Primary	**County**	**Municipality**
False	Allegheny	Millvale Borough
System	**Project**	**Households served**
True	False	0

Primary	**County**	**Municipality**
False	Allegheny	Reserve Township
System	**Project**	**Households served**
True	False	0

Primary	**County**	**Municipality**
False	Allegheny	Aspinwall Borough
System	**Project**	**Households served**
True	False	0

Primary	**County**	**Municipality**
False	Allegheny	Fox Chapel Borough
System	**Project**	**Households served**
True	False	0

Congress	**House**	**Senate**
Mike, Doyle	Adam, Ravenstahl	Jay, Costa Jr.

PROJECT PLAN

Indicate the important dates for Pre-Construction, Construction and Major Milestones.

Pre Construction Planning Dates	
Planning Consultation	Jul 3 2018
Planning Completed	Aug 3 2018
Design Completed	Aug 7 2018
Obtained all needed permits	Aug 8 2018
Bid Date	Nov 12 2018
Bid Opening	Dec 5 2018
Awarded Contract	Feb 1 2019
Pre-Construction Conference	Feb 15 2019

Letter of No-Prejudice	
Letter of No-Prejudice (LONP) issued (if required). Date is entered by PENNVEST Project Management Office upon request and issue of letter.	

Construction Dates	
Start Construction	Mar 1 2019
End Construction	Dec 31 2019

Award Design Dates	
Begin Design	Feb 1 2018
End Design	Aug 7 2018

Project Plan Major Milestones

NOTES:

Regarding necessary permits - part of the construction of the private side portion of the service line requires the work to be done by a licensed plumber with a permit issued by the Allegheny County Health Department. These permits will be obtained by the Contractor's licensed plumber once lead service lines are identified as part of the construction process. In addition, Road Opening and Traffic Obstruction permits will be obtained by the Construction Contractors from the City of Pittsburgh

MEASURES	
Land Use:	
Has the area served by this project been covered by an adopted municipal comprehensive plan?	YES
Is this project located in an area where there is an adopted county comprehensive plan?	YES
Is there an adopted multi-municipal or multi-county comprehensive plan for the area(s) covered by this project?	NO
Is there an adopted county or municipal zoning ordinance or a joint municipal zoning ordinance for the area covered by this project?	YES
Is the proposed project consistent with these comprehensive plans and/or zoning ordinances?	YES

DrinkingWater Breakdown	
Planning & Design only	$0.00
Source Development Amount	$0.00
Transmission Amount	$0.00
Treatment Amount	$0.00
Finished Water Storage Amount	$0.00
Distribution System Amount	$49,710,104.00
Pump Stations Amount	$0.00
Meters Amount	$0.00
Safety/Security Amount	$0.00
Purchase of Systems Amount	$0.00
Restructuring Amount	$0.00
Land Acquisition Amount	$0.00

DrinkingWater Compliance:	
Does the project help the facility to bring out of compliance system back into compliance?	YES
If yes, enter what percentage of the project meets that criteria:	100.00%
Does the project help the facility to maintain current compliance?	YES
If yes, enter what percentage of the project meets that criteria:	100.00%
Does the project help the facility to achieve compliance with upcoming requirements?	NO
Does the project assist the facility with other non-compliance related activities?	YES
If yes, enter what percentage of the project meets that criteria:	100.00%
DrinkingWater Enhancements:	

Does the project help enhance well capacity? (source development/upgrade)	NO
Does the project enhance treatment plant capacity?	NO
Does the project enhance security measures at the drinking water facility?	NO
Does project enhance public safety? (Fire hydrants and related)	NO

Notes:

The PWSA is currently under a Consent Order and Agreement with the Pennsylvania Department of Environmental Protection that requires the inventory and replacement of Lead Service Lines (LSL) within the PWSA water system area. The PWSA requirement for future replacement of LSLs (beyond 2018) is based on system wide lead testing completed every six months. Any future exceedance of the drinking water standard for lead will automatically obligate the PWSA to replace a minimum of 7 percent of the LSL in the water system inventory.

BENEFITS

Narrative:

Background
In November 2017 the PA DEP and PWSA entered into a Consent Order and Agreement (COA) related to Violations of the Pennsylvania Safe Drinking Water Act and the Rules and Regulations Promulgated Pursuant Thereto Regarding the Lead and Copper Rule. Part of the COA requires the PWSA to replace 7 percent of the Lead Service Lines in the System on an annual basis, until the PWSA has met the 90th percentile lead action level during two consecutive rounds of 6-month monitoring. Per the COA requirements, PWSA replaced over 1,341 lead service lines between July 1, 2016 and June 30, 2018 and plans to replace an additional 1,341 lead service lines prior to December 31, 2018.

Ongoing 2018 LSLR Program
In early 2018, after legislative changes were made to allow PWSA to offer private lead service line replacements, the Board of Directors of the PWSA approved a $44 million budget for the replacement of public and private lead service lines throughout the PWSA water service area. The policy includes full-line replacement to minimize the potential health impacts of increased lead levels in water typically found when doing partial lead line replacement only. The PWSA currently has five contractors working in various parts of the City.

2019 LSLR Program
In order to maintain the momentum of the 2018 LSLR Program, the PWSA is applying for PENNVEST funding of $50 million to continue replacing lead service lines within the service area. The 2019 LSLR Program will closely follow the 2018 program (with minor revisions due to PENNVEST policies) offering full service line replacement at homes where there is both a public and private lead service line present. The replacement areas will be selected based on a combination of factors including: available Curb Box Inspection data, Allegheny County Health Department data related to the presence of children under the age of six and child blood lead levels, and streets where the PWSA has determined high densities of public lead service lines. Based on the CBI work order areas, we anticipate the 2019 LSLRs to be completed in the Morningside, Homewood, Perry, Mt. Washington, Southside and Greenfield neighborhoods. The actual locations and addresses will be determined at a later date.

If the PENNVEST funding is approved, the PWSA intends to bid the project in late 2018 and award contracts to four contractors in early 2019. Each contractor would be responsible for replacing 700 public (and 600 private) lead service lines in specific work order areas issued as the program is underway.

Comparison:

As part of the 2018 LSLR Program, the PWSA evaluated several alternatives to full service line replacements. In 2017, the PWSA started a public side only LSLR Program, which included post-construction lead sampling at each residence where a partial replacement (replacing the publicly-owned lead line but leaving a privately-owned portion in place) was completed. Quickly after commencement of the 2017 Program, the PWSA observed elevated post-construction sampling results showing that the partial replacements resulted in adverse health impacts.

Next, the PWSA investigated lining private side lead service lines with epoxy using the E-pipe technology since at the time there was no ability for a public water authority to spend public funds on private property to replace the private line. A pilot area of 6 homes was completed by replacing the public lead line and epoxy-lining the private side at the same time. Although not immediate, the epoxy showed some promise in reducing the overall lead levels. However, since there were no long-term studies to support the design life of this option and there was no way to ensure that the lining was continuous, this option was not pursued further.

After legislative changes were enacted allowing PWSA (and other water authorities across the Commonwealth) to offer private lead service line replacements to its customers, full lead service line replacement was selected as the PWSA's preferred alternative.

Drinking Water Development:	
Capacity	gpd
Dam	NO
Well	NO
Water Surface Intake	NO
Interconnection	NO
New Source	NO
Rehab Existing Source	NO

Drinking Water Source Transmission:	
Total Pipe Length	feet
New	NO
Clean/Reline	NO
Replace	NO

Drinking Water Source Treatment:	
Existing Capacity	gpd
Proposed Designed Capacity	gpd
New Plant	NO
Plant Addition	NO
Plant Renovations	NO

OTHER:

Drinking Water Source Finished Water Storage:	
Total Pipe Length	gallons
New Tank	NO
Cover Existing Tank	NO
Renovate Existing Tank	NO

Drinking Water Source Distribution System:	
Total Pipe Length	42000 feet
Number of Residential Connections	2800
Number of Commercial Connections	0
New	NO
Replace	YES
Extension	NO
Clean/Reline	NO

Drinking Water Source Pump Stations:	
Design Capacity	gpd

New	NO
Renovate Existing	NO

Drinking Water Source Meters:

Number of Master meters	
Number of Customer meters	
New Meters	NO
Replace Meters	NO

Drinking Water Source Other:

Number of New Fire Hydrants	
Plant Access Road	NO
Administration Building	NO

Green Infrastructure Components

Does the project result in reduced (minimum 20%) water use?	NO
If 'Yes' explain:	
Does the project recycle water?	NO
If 'Yes' explain:	
Does the project reduce (minimum 20%) infiltration of water into the sewer pipes being repaired/replaced?	NO
If 'Yes' explain:	
Does the project reduce (minimum 20%) leakage from the water pipes being repaired/replaced?	NO
If 'Yes' explain:	
Does the project save energy (minimum 20%)?	NO
If 'Yes' explain:	
Does the project infiltrate, evapo-transpire or control stormwater?	NO
If 'Yes' explain:	
Does the project implement Ag BMP's, or Low-Impact Development, or wetland restoration or construction, or greenhouse gas reduction, or apply differential uses of water treated to varying levels?	NO
If 'Yes' explain:	

Cost Effectiveness

Describe the alternatives that were considered to solve the problem in the Project Description and the cost of those alternatives.

Two main alternatives to full line replacement were evaluated and both were rejected. Initially a public-side only partial replacement program was implemented by the PWSA. The post-construction lead testing, however, showed elevated lead levels after the partial replacements were completed. Next a pilot study of epoxy lining of the private side service lines (along with public line replacement) was completed; however the results and uncertainty of the long-term effectiveness deemed this alternative not feasible. Based on the results of these two alternatives, along with legislative approval to spend public funds on private property, made full service line replacement the most feasible alternative.

Drinking Water Public Health:

Will this project eliminate critical or chronic health hazards?	YES
If 'Yes' explain: True	
Violation of a primary MCL or maximum containment concentration:	YES
Presence of coliform or fecal coliform:	NO
No water available at the tap:	NO
Giarda cysts in the filtered water:	NO

Drinking Water DEP Compliance

Will this project satisfy an order issued by DEP, the Federal Government or the Courts that addresses problems with acute health or safety hazard, potable water treatment and/or storage facilities?	YES
If 'YES' explain: In response of COA between PWSA and DEP dated November 17, 2017	
Will this project satisfy a non-compliance consent order and agreement related to a health or safety hazard, potable water treatment and/or storage facilities?	YES
If 'YES' explain: DEP dated November 17, 2017	
Will this project protect water sources under the supplier's control?	NO
Provide treatment adequate to assure that public health is protected?	NO
Provide and effectively operate and maintain public water system facilities?	NO
Take corrective action necessary to assure safe and potable water is continuously supplied to the user:	YES

Cost Effectiveness

Describe any actions necessary to get the project under construction, when they will be done, and what will be required in order to maintain the facility through its design life.	

Two main alternatives to full line replacement were evaluated and both were rejected. Initially a public-side only partial replacement program was implemented by the PWSA. The post-construction lead testing, however, showed elevated lead levels after the partial replacements were completed. Next a pilot study of epoxy lining of the private side service lines (along with public line replacement) was completed; however the results and uncertainty of the long-term effectiveness deemed this alternative not feasible. Based on the results of these two alternatives, along with legislative approval to spend public funds on private property, made full service line replacement the most feasible alternative.

Drinking Water Environmental/Social

Explain any existing environmental condition that will be addressed with the project (example: sludge handling facility).	
The project will address the potential for corrosion of lead service lines affecting the public health of PWSA customers.	
How will this project improve the quality of life for the system customers?	
By reducing the potential for lead exposure in drinking water.	
Is this project consistent with local, county and regional land use planning?	YES
If 'No' explain:	
Is this project consistent with county agricultural preservation efforts?	YES
If 'No' explain:	

Drinking Water Adequacy and Efficiency

Will this project increase the available water?	NO
Does this project include or promote water system conservation?	NO
Does this project include or promote water system consolidation?	NO

Drinking Water Public Safety

Will this project address replacement or major rehabilitation of an unsafe water supply storage tank?	NO
Will this project allow the system to meet fire code - quantity/pressure for fire protection?	NO
Does this project include installation or replacement of fire hydrants?	NO
Does this project include work to address safety standards with OSHA?	NO
Will this project address issues related to water source and/or system security?	NO

Keystone:

Have any of the communities served by this project been designated as distressed under the Municipalities Financial Recovery Act 47 of 1987?	NO
Does this project directly serve a Brownfield site as designated by the PA Department of Environmental Protection?	NO
Does this project serve a City, Borough or Township of the 1st Class?	YES
Have any of the communities served by this project been designated as a Community Action Team [CAT] project by the Department of Community and Economic Development?	NO
municipality: county:	
Does the Community(ies) where this project is located have a Comprehensive Land Use Plan?	YES
If yes, is this project consistent with that plan? If yes, please upload a copy of correspondence indicating consistency in Supporting Documents.	YES
Does the County(ies) where this project is located have a Comprehensive Land Use Plan?	YES

If yes, is this project consistent with that plan?	YES

Does the County(ies) where this project is located have an Agricultural Land Preservation Plan?	YES
If yes, is this project consistent with that plan?	YES

INCOME AND EXPENSES

Billing:	Per Last Completed Fiscal Year 2017	First Year after Project Completed 2020
Estimated Population	7000	7000
Households served by System	2800	2800
Total EDUs served by system	2800	2800
Residential EDUs served by system	2800	2800
Average annual Residential bill	$670.45	$1,172.41
Total residential bills levied	$1,877,260.00	$3,282,748.00
Total Residential bills collected	$1,877,260.00	$3,282,748.00
Total Commercial/Industrial bills levied	$0.00	$0.00
Total Commercial/Industrial bills collected	$0.00	$0.00

Income for Government Entity:	Per Last Completed Fiscal Year 2017	First Year after Project Completed 2020
Total Bills Collected	$1,877,260.00	$3,282,748.00
Other Charges Collected	$0.00	$0.00
Total Operating Revenues	*$1,877,260.00*	*$3,282,748.00*
Non-Operating Revenues	($235,338.00)	($263,415.00)
TOTAL INCOME	**$2,112,598.00**	**$3,546,163.00**

Explain other charges, non-operating revenues and identify sources of the above information: Non-operating revenues provided above are a pro rata share of revenue collected by the Authority for such activities as fire hydrant sales, tap fees, shut fees, and penalties and interest.
Sources:
Population is estimated based on the number of connections and people per household. The average annual residential bill is based on a residential customer with a 5/8" meter and 3,000 gallons of monthly usage. This is consistent with our Tariff filing with the PUC. Rates for 2020 are based on anticipated rate increases.

The Financial Model is attached.

Operating Expenses :	Per Last Completed Fiscal Year 2017	First Year after Project Completed 2020
Labor (Salaries and Benefits)	$497,929.00	$852,835.00
Utilities	$123,912.00	$136,872.00
Rent	$21,859.00	$25,877.00
Materials and Supplies	$164,281.00	$304,051.00

Outside Services	$250,938.00	$411,563.00
Cost of Goods Sold	$0.00	$0.00
Program Expenses	$153,272.00	$254,959.00
Administration Expenses	$77,372.00	$86,085.00
Professional Fees	$326,847.00	$537,250.00
Depreciation Expense	$374,307.00	$0.00
Other Expenses	$407,283.00	$368,249.00
Net Operating Expense (Less Depreciation)	**$2,023,693.00**	**$2,977,741.00**

Non-Operating Expenses :	**Per Last Completed Fiscal Year 2017**	**First Year after Project Completed 2020**
Annual debt service excluding this project	$1,204,614.00	$1,813,097.00
Other Non-Operating Expense	$88,972.00	$173,607.00
Net Non-Operating Expense	**$1,293,586.00**	**$1,986,704.00**
Total Expenses	**$3,317,279.00**	**$4,964,445.00**

Explain any Other Expenses and identify sources of the above information: Non-operating revenues provided above are a pro rata share of revenue collected by the Authority for such activities as fire hydrant sales, tap fees, shut fees, and penalties and interest.
Sources:
All expenses for FY2017 are from Audited Financials. FY2020 expenses are based on financial projections included in the attached model.

Net Cash:	**Per Last Completed Fiscal Year 2017**	**First Year after Project Completed 2020**
Total Income	$2,112,598.00	$3,546,163.00
Total Cash Expenses	$3,317,279.00	$4,964,445.00
NET CASH FLOW	**($1,204,681.00)**	**($1,418,282.00)**

Notes:

Expenses and non-operating revenues are based on a per-capita pro-rata share of the total system financials for this service area. Calculations are included in the attached model.

FINANCIAL

Source:	**Amount**	**Committed**
System Funds (resources, Owner equity, etc.)	$0.00	$0.00
Connection Fees / Tap Fees / Assessments	$0.00	$0.00
Grants	$0.00	$0.00

Other	$0.00	$0.00
Amount Requested from PENNVEST	$0.00	$0.00

Special Assessments :	**Amount**
Amount of Assement per EDU	$0.00
No. of EDUs to be Charged	
Anticipated Collection Rate	
Total to be Generated by Assessments	

Explanation of Sources :

If you have chosen not to utilize other available sources of funding for this project, please explain the basis for your decision:

Initiated conversations with PENNVEST before exploring other options.

Describe any constitutional, statutory, charter, or other limitation on debt that apply to the applicant:

Rate adjustments and debt are subject to PUC regulation.

Debt Obligations :

For Governmental entities:	**For non-Governmental entities:**
a) First lien on user charge revenues	a) Guarantee of the parent company
b) Guarantee of municipality	b) Pledge of stock
c) Municipal taxing power	c) Mortgage lien on company facilities

Are there any liens or other encumbrances by existing debt obligations which would prevent PENNVEST from requesting any of the above forms of loan security? YES

Closely Held for Profit Entities :

Owner	**Percent**

NOTES:

Regarding Loan Security, the Authority currently has several outstanding bond issues on various lien levels governed by inter-creditor agreements. This will factor into structuring any PENNVEST loan.

DEBT

Current Debt as of Date of Submittal:

Note Holder: 2013 Series A

Date of Loan / Issue	Original Principal	Interest Rate
Dec 1 2013	$130,215,000.00	3.25%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
360	$11,738,700.00	$93,825,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2013 Series B

Date of Loan / Issue	Original Principal	Interest Rate
Dec 1 2013	$86,695,000.00	4.00%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
300	$2,034,900.00	$38,760,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2017 Series A

Date of Loan / Issue	Original Principal	Interest Rate
Dec 1 2017	$159,795,000.00	4.00%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
168	$19,946,650.00	$15,979,500.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2017 Series B

Date of Loan / Issue	Original Principal	Interest Rate
Dec 1 2017	$5,595,000.00	1.89%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
12	$5,595,000.00	$4,495,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2017 Series C

Date of Loan / Issue	Original Principal	Interest Rate
Dec 1 2017	$218,805,000.00	4.40%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
264	$9,659,496.00	$218,805,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2008 Series C-1 (A-D)

Date of Loan / Issue	Original Principal	Interest Rate
Jun 1 2008	$51,870,000.00	4.60%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
204	$2,410,744.00	$51,840,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: 2008 Series C-2

Date of Loan / Issue	Original Principal	Interest Rate
Jun 1 2008	$51,885,000.00	4.70%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
360	$2,444,566.00	$51,820,000.00

Additional Information on Current Debt:

Current Debt as of Date of Submittal:

Note Holder: PENNVEST

Date of Loan / Issue	Original Principal	Interest Rate
Jun 1 2001	$34,000,000.00	2.00%
Term Months	**Annual Repayment of Principal & Interest**	**Remaining Principal**
20	$3,904,141.00	$29,136,000.00

Additional Information on Current Debt:

Obligation :

Obligation : Revolving Line of Credit with JP Morgan

Date of Obligation	Amount	Security/Collateral
7/1/2016 12:00:00 AM	$80,000,000.00	#Error

Additional Information on Obligation:

$80,000,000 represents the full amount available to be borrowed. Currently the PWSA has drawn $68,900,000 of the full amount available.
Security/Collateral is subordinate to First Lien Debt.

Notes:

RATES

Billing:

Select the appropriate rate structure and billing frequency from the drop down list that is provided. In the space provided, describe any special rate structure or agreement.

	Monthly	Quarterly	Other
Metered	YES	NO	NO
Flat	YES	NO	NO
other	NO	NO	NO

Special Rate Structure or Agreement:

Flat fee includes a minimum volumetric allowance.

Revenue:

Indicate the total revenues collected by category as indicated before and after the project.

	Before Project	After Project
Residential	$1,877,260.00	$3,282,748.00
Commercial	$0.00	$0.00
Industrial	$0.00	$0.00

Customers :

Indicate the number of residential households that the system currently serves and the number that you expect to serve once this project is complete. Provide similar information for EDU's (equivalent dwelling units) and population that will be impacted by the project.

	Currently	After First Year
Residential Households Served	2800	2800
Number of Additional EDU's	0	
Estimated Population Impacted	7000	

NOTES:

BUDGET

Engineering Costs:

This section is used to provide a breakdown of project engineering costs related to planning. For Waste Water projects these costs should represent expenses that are not related to Act 537 planning.

Tasks	
Planning	$0.00
Pre-Design Services	$0.00
Design	$0.00
Bidding	$0.00
Construction Services	$5,105,505.24
Total Engineer Cost	**$5,105,505.24**

Construction Items:

This section is used to provide a breakdown of project costs relatated to construction for Transmission/Interceptor, Mains, Pump Station, Storage, Treatment and Source/Disposal. *Use linear feet for length.*

	Units	Estimated Cost
Transmission/Interceptor	linear ft	
Mains	linear ft	
Pump Station	stations	
Storage	gallons	
Treatment	gallons	
Source/Disposal	gallons	
LSLR Connections	2800 connection	$49,710,104.00
Total Construction Cost :		**$49,710,104.00**

Total Major Phases Costs:

This section is used to provide a breakdown of all project related costs as they relate to pre-design, design and construction components of the project. These figures are typically estimates, based upon consulting services and engineering design specifications.

	Major Phases		
Cost Category	**Pre-Design**	**Design**	**Construction**
Administrative Costs	$0.00	$0.00	$1,502,228.70

Legal Fees	$0.00	$0.00	$0.00
Financial / ... Accounting Charges	$0.00	$0.00	$0.00
Interest during Construction	$0.00	$0.00	$0.00
Engineering, Architecture Fees	$0.00	$0.00	$6,229,136.71
Permits	$0.00	$0.00	$0.00
Land	$0.00	$0.00	$0.00
Construction	$0.00	$0.00	$38,162,489.40
Contingency	$0.00	$0.00	$3,816,248.95
Grand Totals	**$0.00**	**$0.00**	**$49,710,103.76**

Total Project Costs :

Cost Category	Total Cost
Administrative Costs	$1,502,228.70
Legal Fees	$0.00
Financial / ... Accounting Charges	$0.00
Interest during Construction	$0.00
Engineering, Architecture Fees	$6,229,136.71
Permits	$0.00
Land	$0.00
Construction	$38,162,489.40
Contingency	$3,816,248.95
	$0.00
Total Project Cost :	**$49,710,103.76**

Additional information or comments :

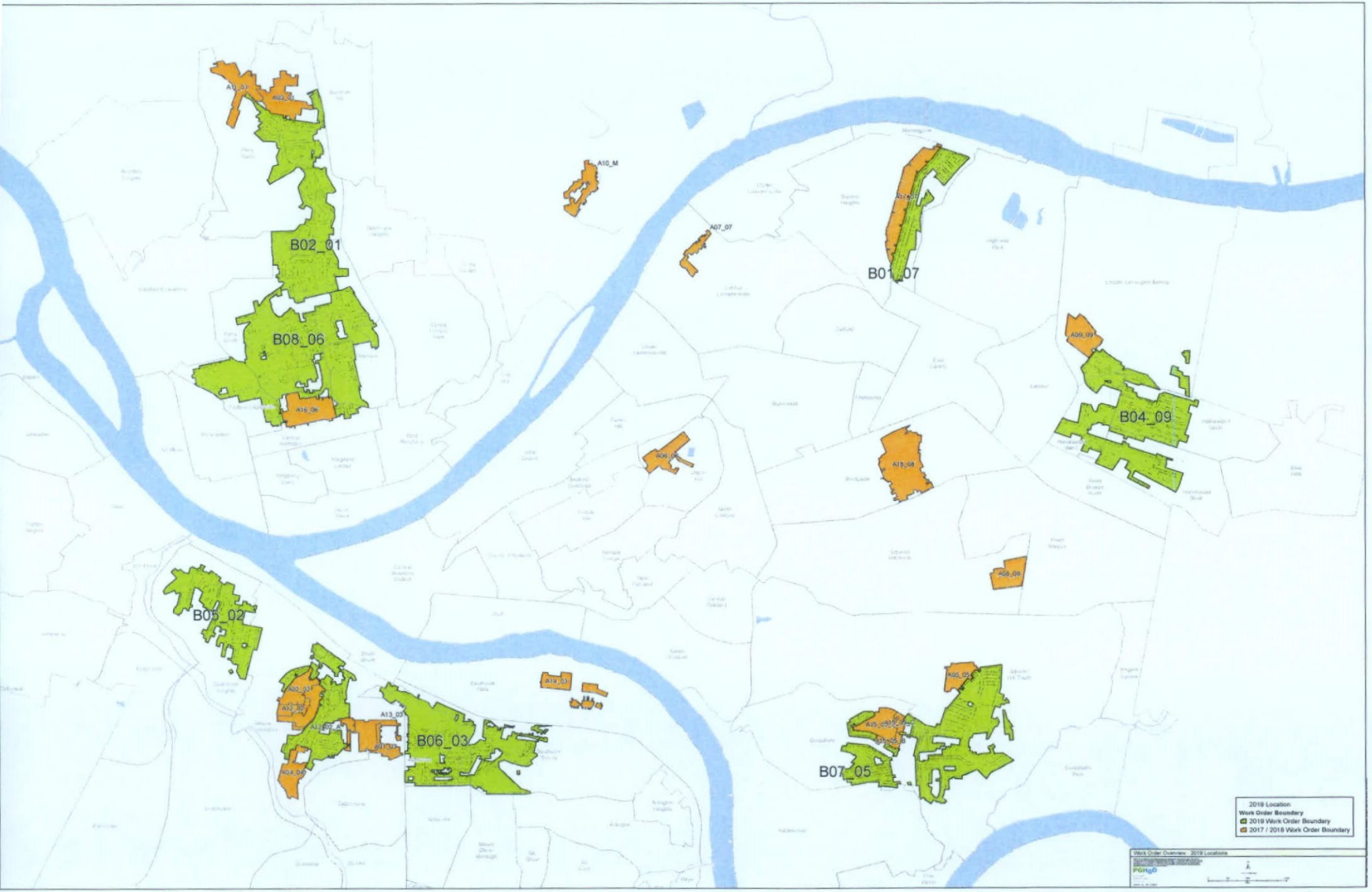
IMPACT

Industry:

Economic Benefits: Indicate the economic benefits of the project relative to job creation/retention and private investment. Attachments should be clearly identified and forwarded to DCED for review.

Notes:

Exh. RAW/C-24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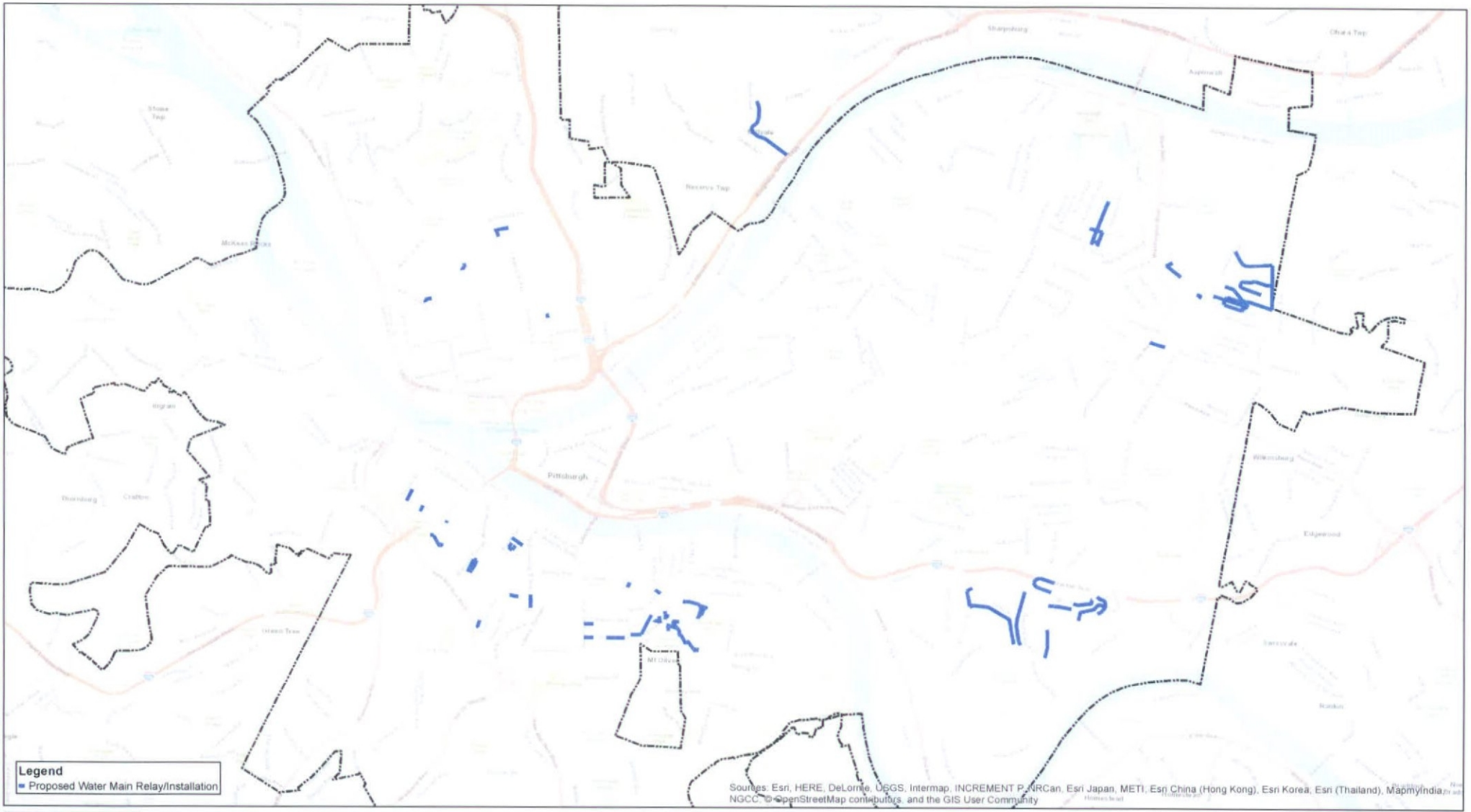
B08_06
A10_M
A07_07
B01_07
A09_09
B04_09
A15_08
A08_08
B05_02
B06_03
B07_05
2019 Location
Work Order Boundary
2019 Work Order Boundary
2017 / 2018 Work Order Boundary
Work Order Overview - 2019 Locations

Exh. RAW/C-25



PGH2O
Pittsburgh
Water & Sewer
Authority

Drawn by: JDS Date: 1/25/2019

Neither the City of Pittsburgh nor the PWSA guarantees the accuracy of any of the information hereby made available, including but not limited to information concerning the location and condition of underground structures, and neither assumes any responsibility for any conclusions or interpretations made on the basis of such information. COP and PWSA assume no responsibility for any understanding or representations made by their agents or employees unless such understanding or representations are expressly set forth in a duly authorized written document, and such document expressly provides that responsibility therefore is assumed by the City or the PWSA.

N
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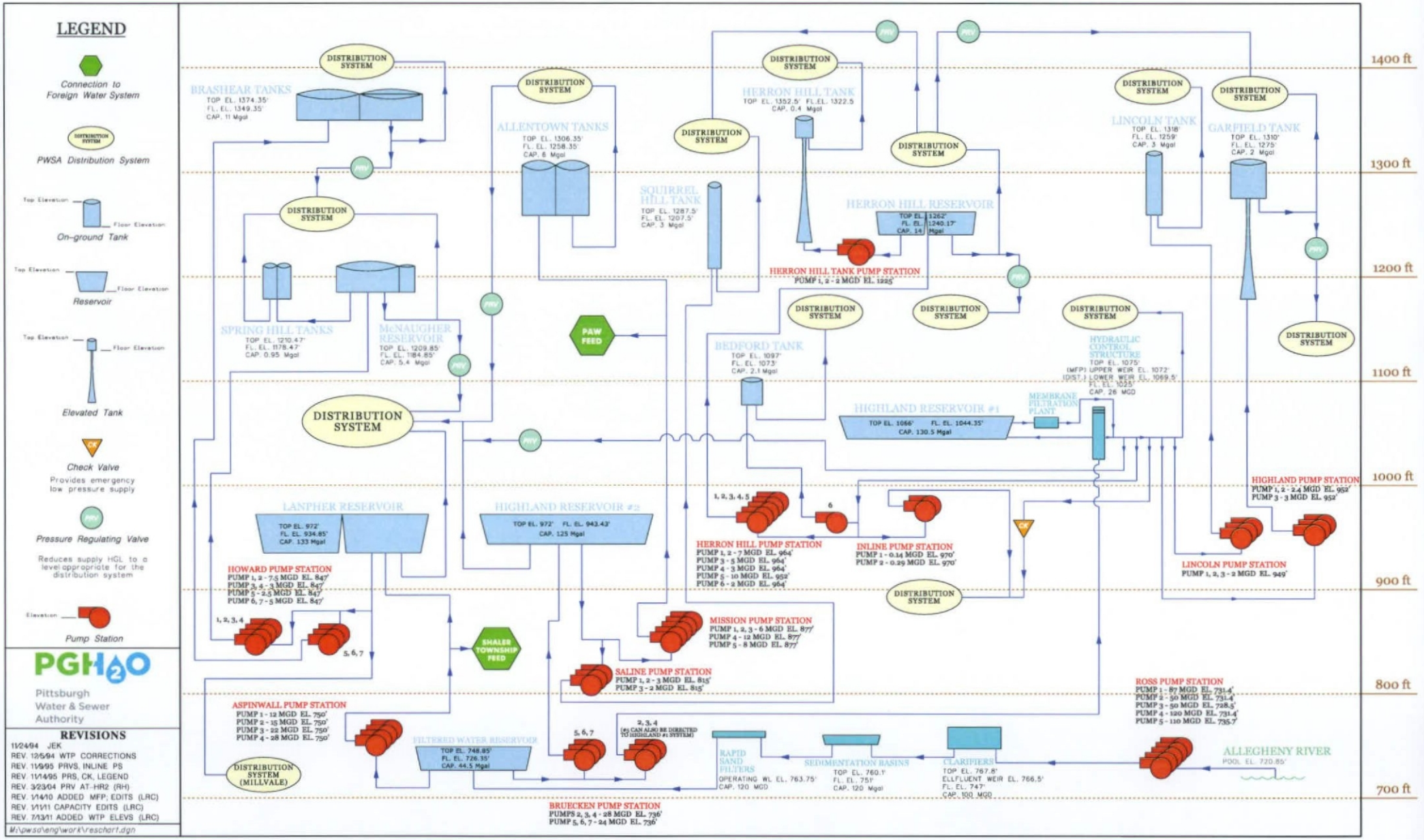
0 2,000 4,000 Feet

M:\pwsa\eng\gre\lm\2020 Water Main Replacement Contract\MXD\Attachment 7 Overview Map- 2020 Water Main Relay Locations.mxd

Attachment 7
2020 Water Main Replacement Contract
Overview Map

Exh. RAWC-26



PITTSBURGH WATER SYSTEM SCHEMATIC

ELEVATIONS APPLY ONLY TO TANKS, RESERVOIRS, AND PUMP STATIONS

Exh. RAW/C-27

Water Supply & Pressure Districts Boundaries

